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PATENTS FOR INVENTIONS.

ABRIDGMENTS

OF

Specifications

RELATING TO

METALS AND ALLOYS,

[*Excepting* IRON AND STEEL].

PART III.—A.D. 1877–1883

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PREFACE.

This volume contains abridgments of Specifications relating to the manufacture of "Metals and Alloys, [*excepting* Iron and Steel]," filed during the period A.D. 1877–83. Inventions relating to the "Manufacture of Iron and Steel" are dealt with in a separate volume.

The scope of the volume, as shown in the subject-matter index, comprises the dressing, smelting, and other treatment of metalliferous ores, as raised from the mine, for the production of metals therefrom (otherwise than by electrodeposition); also improvements in alloys, amalgams, and some analogous compounds containing phosphorus. Under the term "metals" is comprised not only the metals in general use (iron and steel excepted), but rare metals such as tungsten and uranium, and the metals of the alkalies and alkaline earths; while the alloys include those containing iron or steel (except certain alloys regarded as varieties of, or employed in making, iron or steel).

Furnaces and kilns for the treatment of ores and production of metals and alloys are as a rule contained in this volume; but where the improvements are restricted to methods of effecting combustion, and are primarily applicable not only to metallurgical but also to other classes of furnaces, the inventions are omitted.

Inventions relating to crucibles and refractory materials for building furnaces etc. are included.

The subject of rolling metals into bars, rods, sheets, wire, etc., is included in the series relating to iron and steel; but the present volume comprises inventions relating to the rolling of specified metals other than iron and steel. Improvements on the subject of annealing metals are also included. The manufacture of finished articles generally is excluded, as well as the work of the smith's and engineer's shops.

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PREFACE

It should be pointed out that some subjects herein partly dealt with, such as furnaces, and other matters collateral to the essentially metallurgical treatment, have been completely dealt with in their place in the various illustrated series of abridgments now issued, to which reference should be made by persons desirous of making a thorough search.

Full information as to the volume of abridgments within which abridgments for any given subject occur may be obtained from the *Abridgment-Class and Index Key*. This publication, which gives all particulars with regard to the Patent Office classification of inventions, may be obtained from the Patent Office Sale Branch, 38, Cursitor Street, Chancery Lane, E.C., price One Shilling, postage (parcel post) Sixpence.

It should be borne in mind that the abridgments are merely intended to serve as guides to the Specifications, which must themselves be consulted for the details of any particular invention. Printed Specifications, price Eightpence each, may be purchased at the Patent Office Sale Branch, or ordered by post on the Patents Form C[1] (to be obtained from any Post Office), no additional charge being made for postage.

H. READER LACK,

January, 1894 *Comptroller-General.*

SUBJECT-MATTER INDEX.

Abridgments are printed in the chronological order of the Specifications to which they refer, and this index quotes only the year and number of each Specification.

NAME INDEX.

e na es in *italics* are those of persons by whom inventions have been communicated to the applicants for Letters Patent.

METALS AND ALLOYS.

(*Excepting* IRON AND STEEL.)

A.D. 1877.

A.D. 1877, January 5.—No. 61.

SMITH, Thomas James.—(*A communication from Albert Piat.*) —Crucible furnaces and crucibles.

A crucible is combined with a furnace or casing containing fuel, for heating the crucible and melting metals therein. The fluid metal may be poured " by tilting the furnace and crucible " only as an apparatus in itself " on bearers at the melting-place, or by conveying it suspended to a distance, the apparatus being " independent of any separate carriage or lower frame or " part of the stack." Uprights may be arranged as fixed appendages to the stack, and form " supports or bearings on " to which is temporarily hung by its axle arms or trunnions " a cylindrical or other shaped casing (furnace), lined or not " with a refractory material and forming a chamber in which " the crucible is placed; a space being left " around the crucible for the fuel, and a blast being sometimes employed. Below the casing is a jacket, which when the casing is vertical " closes the bottom by a luting at the joint or seam, and forms " a chamber leading to a channel " for the entrance of air for combustion. The top and bottom of the casing, which are open, can be closed by plugs or stoppers supported by cross-bars or otherwise. To support the crucible, one stopper is " preferably of metal floated with a refractory material," and it has holes in it at the sides for the entrance of air. When it is removed the spout or tap-hole of the crucible becomes uncovered for pouring out the fluid metal, the top of the casing, however, being closed by a refractory plug to prevent

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loss of heat. Sometimes the first part of the heating takes place with the casing and crucible in an inverted position, the mouth of the latter being closed by an obturator with perforated sides for the supply of air. Adjustable side pieces hold the crucible in position. The trunnions may have square or other shaped ends, over which sockets or clips of long arms can be shipped for lifting and carrying the apparatus to the moulds. Crucibles may be employed "having openings at or "near the bottom, from which by an attachable pipe spout "arrangement the fluid metal can be poured into moulds." A drawing shows a spout, arranged inside the casing and extending from the bottom of the crucible to the top of the casing, and it communicates with the crucible by apertures at the bottom and near the top of the latter. The number of outlets from the crucibles may be varied, as well as the arrangements in other respects. A crucible within a portable furnace is not claimed broadly.

[*Printed*, 6*d*. *Drawings*.]

A.D. 1877, January 9.—No. 96.

WIRTH, Frank.—(*A communication from Nikolaus Betz.*)—Scaling, cleaning, and polishing wire.

The wire is drawn off a reel through a claw-guide to remove loops, then over six wheels of which Nos. 1 and 4 simply guide its path, while Nos. 2, 3, 5, 6 clean it from scales on the lower, upper, right, and left sides respectively. The wire is then drawn through a polishing-box filled with calves' hair and sand, the chain used for drawing the wire being made to travel over the box by resting on "two half guide rolls" while the wire being thinner falls between these into the box.

[*Printed*, 6*d*. *Drawings*.]

A.D. 1877, January 11.—No. 150.

TURNOCK, Joseph Rushton.—(*Provisional protection only.*)—Manufacture of tin and terne plates.

To the ordinary tinpot is added a partition which is perforated from the bottom to within a short distance of the molten surface, above which the partition extends for about six inches, forming a reduced receptacle for the grease. The partition, by

narrowing the mouth of the pot, prevents the introduction of too many plates, and permits the use of a large pot, thus obtaining a more equable temperature, without having to cover the whole surface with grease.

[*Printed*, 2*d*. *No Drawings.*]

A.D. 1877, January 11.—No. 154.

DELF, WILLIAM.—(*Provisional protection only.*)—Separating, cleaning, and sizing.

Ores etc. may be sorted. The apparatus, which is described with reference to the treatment of grain, comprises a frame, in which are placed several shelves "consisting of wires set to "various gauges, the wires being either round or partly round "and flat: the shelves or screens are either fixed or moveable," and arranged one above another in steps. The screens are made of gauges suitable for the intended purposes, "and either "in a plane or they are made more or less concave or convex. "Underneath the top row of screens may be placed another "screen" for acting further. The grain etc. travels over a shelf "on to the first wire screen, and from thence to the second, "and so on, falling step by step from screen to screen." The working of the machine is regulated by adjusting the inclination of the screens, and the whole machine may be set to any incline by altering the position of its supporting legs. The screens, which rest on projections let into the sides of the frame, are "provided at top and bottom with graduated irons."

[*Printed*, 2*d*. *No Drawings.*]

A.D. 1877, January 12.—No. 166.

BAGGELEY, HENRY.—Firebricks.

Firebricks may be made from a mixture of 100 lbs. of chalk or whitening, 64 of pipeclay (or an equivalent of other refractory clay), 4 of horse dung, ½ of asbestos or 6 of flint, and 6 of green glass. The latter increases the hardness of the bricks, but somewhat effects their refractory quality, and may therefore be dispensed with. The ingredients are ground, and moistened with just enough water for compressing and consolidating the mixture in moulds, the bricks obtained being afterwards fired for about from 48 to 60 hours.

[*Printed*, 4*d*. *No Drawings.*]

A.D. 1877, January 15.—No. 196.

GIROUD, Henry.—Alloys.

Alloys for the casings and covers of gas regulators, consisting of 90 parts lead and 10 antimony, and for the bells of the regulators, consisting of 94 parts tin and 6 parts nickel.

[*Printed*, 6*d*. *Drawing*.]

A.D. 1877, January 20.—No. 265.

HOLLWAY, John.—" Production of metals or metallic alloys."

By a process similar to that to which the inventor's prior Specifications Nos. 1446 and 3314, A.D. 1876, relate, metallic compounds, including specific qualities of metals or alloys, may be produced and metalliferous substances in powder or otherwise difficult of reduction be utilized. Ores or other metalliferous substances, fluxes, and coal or other carbonaceous materials (including pitch or other bituminous matter) may be pulverized or disintegrated, washed, or otherwise purified, if required, and well mixed together. From the mixture there is produced a metallic coke, which is afterwards smelted. In order to be sound, the coke must contain more carbon than will suffice to smelt the metalliferous substances present ; hence additional metalliferous substances may be smelted therewith, sometimes adding ordinary coke. The process is well adapted for producing metallic compounds or alloys of iron and nickel, titanium, tungsten, or other metals, the proportions of the ingredients being easily controlled. Such oxides as those of chromium, titanium, cerium, or manganese resist hot carbonic oxide, but are " reducible by intimate contact " with carbon or with metallic iron and carbon." Sometimes the mixture is pressed into blocks with the aid of binding-materials and introduced into the smelting-furnace without being previously coked.

[*Printed*, 6*d*. *No Drawings*.]

A.D. 1877, January 23.—No. 283.

FISHER, Alfred Francis John.—(*Provisional protection only*.)—Reverberatory furnaces for puddling.

The bottom plate of the furnace is cast with a continuous hole or holes, passing any suitable number of times across the cast iron forming the plate ; or the plate may be divided into

parts which are thus treated. The holes are used as waterways, the water being regulated according to the heat which the plate receives. The waterways may be made by sand cores and passed through from side to side of the bottom, and stopped by plugs or by wrought-iron tubular elbows or bends, or by moulding cross or connecting cores within the plate. Such bottoms are "rendered more enduring by being left to expand and contract "without restraint by the unequal heat applied to them." Sometimes wrought-iron rods may be laid in the mould, above or below the cores, to strengthen the plate; or "may be placed "in addition across the plate in the direction of the waterways."

[*Printed*, 2*d*. *No Drawings.*]

A.D. 1877, January 23.—No. 293.

DALTON, George.—Breaking stones etc.

In breaking between a movable and a stationary jaw, motion may be transmitted from the rocking lever or pitman to the movable jaw by means of toggles, the length of which is adjustable to regulate the distance between the two jaws. For this purpose the toggle may be made in two or more lengths, and a screw be operated by a worm and worm-wheel with or without additional gearing, "all carried by the toggle in such a "manner that under the action of the screw the lengths of "which the compound toggle is composed shall be forced" farther apart or drawn closer together. Or the toggle may comprise two sets of links, those of each set being connected together at one end "to form the toggle head, whilst their "diverging ends are attached respectively to two nuts fitted "with" a right and left handed screw, which causes the nuts to approach to or recede from each other. Or a conical or taper block may be "arranged between the two lengths of the "compound toggle, so that by adjusting its position the "lengths may be moved further apart" or nearer together. The lengths can slide upon connecting pins, and "carry pro-"jections upon which rests a bridge piece forming a bearing "for a set or tightening nut."

To cause the toggles to draw back the movable jaw (dispensing with other retractive devices), the heads of the toggles may be connected to the movable jaw and rocking lever respectively by "cap pieces extending across and attached by screws or other-

"wise to the same," while the said heads can turn freely in their sockets.

The toggle heads, jaw, frame, and rocking lever may have detachable wearing-parts or faces, to be replaced by others when worn. The body of the toggles may be of ordinary cast iron, and the acting portions of the heads of white cast iron, steel, or other hard and durable material.

The invention applies when both jaws are movable.

[*Printed*, 6*d*. *Drawing*.]

A.D. 1877, January 24.—No. 302.

LYSAGHT, JOHN.—Galvanizing and metal-coating apparatus.

Pots for galvanizing and the like. The firebars are placed in a central flue beneath the pot, communicating with return flues at the side, these in turn being connected by a flue traversing the upper part of the metal, and serving to equalize the temperature and reduce the exposed metallic surface. Removable receptacles serve to collect the hard spelter or other deposit.

The entering rolls may or may not be immersed; if the former, they are suspended in wrought-iron forceps similar to those carrying the delivery rolls. The pressure between the immersed rolls is regulated by screws which may have a spring adjustment. The inclination of the plane containing the axes of the delivery rolls can be suitably adjusted. If the rolls are not immersed, the adjustment to the thickness of the plate is effected by screws acting through springs upon the bearings of one of the rolls.

The plate is taken in by the rolls and is conducted by two parallel guides of bar iron to delivery rolls by which it is removed. If necessary, the direction of the rolls may be reversed by means of a clutch on the driving-shaft.

In a modification, the pot is provided with one flue, a fireplace being built of brickwork.

[*Printed*, 6*d*. *Drawings*.]

A.D. 1877, January 25.—No. 327.

LAKE, WILLIAM ROBERT.—(*A communication from Andrew Burrell Lipsey, Joseph Bouton Crosby, Purdy Dickerson Barnhardt, and Samuel Belding Mower.*)—(*Provisional protection only.*)—Pulverizing, disintegrating, and separating machinery.

Ores and various materials may be treated. A series of chambers of successively-larger diameters may be arranged one outside another, with series of beaters for revolving therein. A larger and a smaller chamber may intercommunicate and be provided with beaters "revolving in the same length of time;" consequently those of the larger chamber move at a greater speed, producing a partial vacuum and drawing from the smaller chamber the lighter particles of the material therein pulverized. Again, the beaters of both chambers may be supported on the same shaft and revolve in the same length of time. Each of two or more intercommunicating chambers may be provided with revolving beaters and with lips overlapping the beaters, so that the material is "prevented from passing out of one " chamber into another except at the proper place." Again, there may be "offsets arranged at the inner ends of the beaters " for deflecting material escaping from one chamber into the " middle of the next, so as to present it properly to the beaters " therein."

To support beaters or their equivalents, a long hub may be used extending out beyond the chamber, so that a lubricant applied to the shaft carrying the beaters is prevented from entering the chamber and impairing the quality of materials pulverized therein.

With a pulverizing-machine and an inlet for supplying material for treatment and air or its equivalent thereto, there may be combined a throttle for the inlet for simultaneously regulating the supply of material and of air.

"A laterally oscillating feed shoe or trough, preferably " capable of adjustment at different angles to the horizontal, " and deriving motion from the driving" or other shaft of the machine, may automatically regulate the feed of the material to suit the speed at which the machine is working. Again, a governor or its equivalent may actuate the feeding or supplying device, so that the feed of the material is commensurate with the speed of the machine and will stop when the speed is so slow that the machine might become choked.

A pulverizing-machine may have an outlet, provided preferably at the lower part with one or more openings, and capable of adjustment axially by swinging at different angles, to provide for separating the finer and lighter from the coarser and heavier particles of material delivered from the machine.

With a "beater extending longitudinally from the side of a "disc or spider," there may be combined "a renewable shoe "fitting or lapping over the face, inner edge, and outer end of "such beater, a dowel or projection on the outer end of said "beater fitting a cavity in the contiguous portion of the shoe, "and a rivet, bolt, or equivalent device at the inner end of the "shoe securing it to the aforesaid disc or spider." Thus the shoe may be secured in place without perforating and weakening the beater transversely.

[*Printed*, 4*d*. *No Drawings*.]

A.D. 1877, January 29.—No. 383.

GODFREY, Samuel, and HOWSON, Richard.—Revolving furnaces.

The uses of revolving furnaces, to which the inventors' prior Specification No. 4414, A.D. 1875, relates, are extended to the roasting of ores and other purposes where an intimate mixture or agitation of heated materials is required.

Also, a steam jet may be used to produce the requisite pressure, (gas holders being rendered unnecessary), and is so arranged that the steam mixed with air passes through the incandescent fuel in a gas generator, whereby the steam is decomposed. An internal circulation of steam, instead of water, may be used to protect the burners or tuyères of revolving furnaces, danger of explosion from leakage of water being avoided. The waste gases issuing from the furnace are directed upwards into a chamber containing a series of pipes to be traversed by a blast of air, which is thus heated on its way to meet and burn the gas at the burner. These improvements apply to furnaces mounted on trunnions and revolving at an angle, and to horizontally-revolving furnaces, having a burner at each end or a burner at one end only and an exit for the waste gases at the other. Revolving furnaces may be lined with a mixture of oxide of iron and hydraulic cement, the former being used partly in powder and partly in lumps.

[*Printed*, 6*d*. *Drawing*.]

A.D. 1877, January 31.—No. 415.

LAKE, William Robert. — (*A communication from the American Screw Company.*)—Pickling wire.

The main feature of the invention is the combination with a suitable vat or tub of a displacing-column, whereby the acid occupies an annulus in which the coils of wire are placed.

The liquor used is an aqueous solution of sulphuric acid and etches best whilst mixing. The smaller bulk required by reason of the better distribution gives a correspondingly stronger solution of sulphate of iron.

[*Printed*, 6*d*. *Drawing*.]

A.D. 1877, February 2.—No. 441.

FLETCHER, JOHN.—Crucible furnaces.

A furnace for melting metals and alloys comprises an inner shell, lined internally with refractory material, and surrounded by an outer casing with an intermediate annular air space inside the latter. The shell may be supported by an internal flange on the top of the casing or be otherwise suspended within it. At the bottom of the said casing is hinged and secured or otherwise arranged a lower part, lined with refractory material (in the form of a concave disc) which forms the bottom of the furnace. Within the lining of the shell are the fire and melting-crucible, and the said lower part of the casing forms a door for the discharge of ashes etc. Air is admitted or forced into the upper part of the annular space and, in descending through the latter, becomes heated and checks the overheating of the shell and casing, passing beneath the lined shell into the fuel at the lower part of the fire. The furnace may be provided at the top with a "cap," upon which is a cover or door, and in the side there may be an opening for the products of combustion and fumes to pass to a chimney. The casing may rest upon feet, pillars, or otherwise, so that there is a clear space beneath it. Sometimes the inner shell is dispensed with and the internal lining rests upon pillars or is otherwise sustained.

[*Printed*, 6*d*. *Drawing*.]

A.D. 1877, February 5.—No. 486.

DRAKE, WILLIAM.—Manufacture of metals.

A compound, which is to be mixed with the melted metal in the furnace to improve its quality, may consist of one-fourth part by weight of charcoal and bullock's blood, respectively,

with one part of baryta, the latter being scoured with acids to remove impurities and subsequently calcined and pulverized. The compound may be used in a liquid or moist state (water being added), or in the state of powder, in which case the blood is calcined or dried by heat and pulverized. For treating copper, the compound should consist principally of baryta with a little of the charcoal and blood, but the proportions are varied for the different qualities of the metals according to experiment.

[*Printed*, 2*d*. *No Drawings.*]

A.D. 1877, February 6.—No. 512.

CLARK, ALEXANDER MELVILLE. — (*A communication from Claudius César Paday.*)—Metallurgical processes.

Nitrate of ammonia or its derivatives, produced in accordance with this invention, may be employed "for the dissolution and " distillation of metalloids, metals, ores, &c., concurrently with " metalloids or metals, either separate or combined." The invention relates to "the production of ammoniacal salts by " absorbing ammonia from the air in porous inert substances, " in which it is united with acids or natural salts in order to " form ammoniacal salts and more particularly nitrates;" also " the enrichment in nitrogen of the nitrates already formed, " the quantity of nitrogen increasing in proportion to the " initial production of the salts." The means of production include,—(1), "porous solid substances or substances of vege- " table, mineral, or animal origin in a minutely subdivided " condition;" (2), "fossil or other organic substances, solid or " liquid, at every degree of decomposition;" (3), "gaseous " substances, such as air, steam, or gases, absorbed or pro- " jected into the solid or liquid mass, which they penetrate in a " finely divided condition" so as to multiply the surfaces of contact. The means for effecting the absorption or penetration of the gases or liquids in the nitrifiable or nitrified mass vary, and in the case of liquids may be by force of gravity, while gases and vapours may be distributed by pipes or channels.

[*Printed*, 4*d*. *No Drawings.*]

A.D. 1877, February 12.—No. 584.

TOUSSAINT, JOSEPH.—Crucibles or melting-pots and furnaces therefor.

The crucible is preferably conical from bottom to top: its bottom is rounded, its base is half the diameter of its upper part, and its height about double this diameter. One or more spouts or nozzles lead from its bottom to the outside of the furnace wall, for running off the molten metal when desired. The spout may be moulded with the pot, or as a separate article and be attached to the pot. In moulding, pressure is applied to expel water and close up the pores of the composition employed, in order to give increased strength and power of resisting the action of fire. The crucible is suspended or held in place in a furnace by means of projecting bricks (of the same composition), set at an angle at intervals in the furnace so that the fire may play on all external parts of the crucible, which has a well-fitting cover. Sometimes the crucible may be supported on a foot within the furnace. All kinds of metals may be melted etc., the metallic bodies specified including brass, copper, gold, silver, and zinc.

[*Printed*, 4*d*. *No Drawings*.]

A.D. 1877, February 15.—No 621.

SIMON, HENRY.—(*A communication from Friedrich Schiffner.*) —Crushing ore, stone, etc.

A strong lever or jaw is mounted or pivoted at its lower end on a fulcrum between two inclined cheeks, and to its upper end a limited rocking motion is imparted by an eccentric on a driving-shaft passing through the upper end of the jaw, or a rod may connect the jaw to an eccentric or crank on a shaft apart. Thus the jaw will alternately approach and recede from each cheek in succession, and, as the spaces between the jaw and cheeks decrease in width downwards, the ore placed in such spaces will as it descends be crushed to a degree varying with the size of the narrow openings at the bottom. The upper ends of the cheeks are pivoted on strong transverse bolts; while their lower ends rest upon wedge-shaped sliding blocks, which can be moved by adjusting-screws so as to vary the size of the said openings. An elastic packing may be placed between the cheeks and blocks, so that yielding can take place under excessive strain. The jaw and cheeks are confined at the sides by strong plates, forming a framing, which carries the strong pin or pivot of the jaw as well as the bolts for the cheeks. The acting faces of the jaw and

cheeks, which can be provided with renewable steel or iron plates, may be either plain or curved and either smooth or formed with teeth or projections. The jaw may be made vertically adjustable.

[*Printed*, 6*d*. *Drawing*.]

A.D. 1877, February 15.—No. 630.

YOUNG, James, the younger.—(*Letters Patent void for want of final Specification.*)—Furnaces.

In "furnaces for smelting ores," to obtain a high temperature and economy of fuel, steam may be blown through one or more tuyères arranged in the lower part of the furnace or fireplace. The steam draws in and mixes with air, and the mixture is dispersed among the ignited fuel and "burned."

[*Printed*, 2*d*. *No Drawings*.]

A.D. 1877, February 15.—No. 633.

LYTE, Farnham Maxwell.—Treating ores and residual products containing zinc, lead, silver, or copper.

The ore in a pulverized state, and after calcination if sulphurets are present, is treated with hydrochloric acid (such as equal parts of commercial muriatic acid and water) in a pan, tub, or vessel, furnished interiorly with a steam coil and, if large, with a mechanical stirrer, heating and agitation being thus applied. When the action of the acid is complete (chloridization taking place), all the zinc should have passed into solution together with iron etc. The chlorides of lead and silver may remain partially insoluble in the hot solution. "When the " precipitates from the hot solution have been allowed to settle, " the clear solution containing the zinc and other soluble " chlorides is decanted while still hot into another vessel, where " on cooling nearly the whole of the dissolved lead chloride is " deposited." The supernatant liquid is then drawn off from this deposit and used again, so that the residue or gangue of the ore "may be exhausted by successive decantations, heating, and " cooling, of all the lead and silver chloride it may contain," both chlorides being removed together. Or the residue may admit of treatment for extracting the metallic lead without dissolving it out as described. In either case into "the liquor " containing the precipitate, whether with or without" the

residue, are plunged pieces or filings of zinc, lumps of hard spelter sufficing. Hydrogen is disengaged, and the spelter dissolves, increasing the zinc chloride in solution, while the silver and lead are reduced to a spongy metallic precipitate. The precipitate is washed preferably in a centrifugal machine to thoroughly remove soluble chlorides, and is then compressed into lumps or bricks fit for smelting. To obtain metallic zinc, the zinc chloride solution is first neutralized cold by adding carbonate of lime. After settling, the clear liquid is decanted off and heated. Milk of lime is then added in quantity barely sufficient to precipitate all the oxide of zinc. "Naked steam "from a blow up, driven into the liquid," assists in producing the requisite agitation. The precipitate should be well washed and then pressed into lumps, so as to free it from chloride of calcium. The lumps are used like calcined blende or calamine for the distillation of metallic zinc.

When some silver ores are treated with hydrochloric acid as above described, a quantity of calcined galena, lead sulphate, lead oxide, or other lead compound should be added in the proportion of, say, 100 of lead to 2 of silver in the ore. With the hydrochloric acid may be added a chlorine-generating material to more rapidly decompose sulphurets and chloridize and dissolve metallic silver or gold. Red lead may be used, but the peroxide of manganese, bleaching-powder, chlorates, nitric acid, nitrates, etc. are advantageous. The lead chloride is removed with the gold and silver. After reduction by metallic zinc, the precious metals are separated from the lead by usual methods.

In treating blende containing a little galena and perhaps traces of copper sulphide, the ore without calcination might be treated with hot hydrochloric acid. Some kinds of blende hardly thus dissolve, while the lead and any silver are removed. The copper sulphide and blende remaining can be calcined and treated for distillation of the zinc, copper being extracted from the residuary cupriferous matte.

[*Printed*, 4*d*. *No Drawings*.]

A.D. 1877, ... No. 633*.

Disclaimer and Memorandum of Alteration to the Specification of the preceding invention, filed December 3, A.D. 1881, by Farnham Maxwell Lyte.

The title is altered, so as to omit special reference to copper. Other alterations are of a verbal character.

[*Printed*, 4*d*. *No Drawings*.]

A.D. 1877, February 15.—No. 634.

TOUSSAINT, JOSEPH.—Furnaces (including those for melting and roasting metals and minerals).

The inventor's prior Specification No. 584, A.D. 1877, is referred to.

The inventor claims the construction of a "pit structure "below the level of the ground, to which structure air is free "to enter at its lower part to supply the fire or furnace which "is at the upper part with said air for supporting combustion "and for burning, melting, drying, or heating articles or "material placed in said furnace above the fire, or in the "fire, or in the flues leading therefrom." The depth below the firegrate may be 30 feet more or less, "the greater the "depth the stronger and more rapid will be the column of air" which supplies the fire, the usual high chimney and blowing-apparatus being dispensed with. The fire and heat may act directly upon crucibles or other "containers," particularly such crucible apparatus as the prior Specification relates to. There is a cleaning-door at the level of the grate, and a firing-door about 2 feet higher up. "The heat from the fire when cone-"shaped crucibles are used always finds itself contracted against "the sides when ascending to the top of the crucible and gives "to it greater heat. The space above the top of the crucible "enables the heat to be kept on the top," where the heat is slightly greater than at the sides, "because it is lighter and "concentrated by the opposition of the narrow passage in the "cover" with which the furnace may be provided. A descending outlet flue may check the flow of the gases leaving the furnace, pressure being thus produced on the metal under operation. Four or six ordinary crucibles may be placed in the furnace.

[*Printed*, 4*d*. *No Drawings*.]

A.D. 1877, Feb. 16.—No. 649.

MONTEFIORE, JACOB LEVI.—(*A communication from Edward Levi Montefiore*.)—Treating nickel and cobalt ores.

Finely-powdered nickel ores, containing silicates of nickel and

magnesia with other substances, may be attacked by strong sulphuric acid, preferably at 60° Beaumé either by solution as usual, or by mixing the ore with sufficient sulphuric acid to convert all the nickel and magnesia into sulphates. The mixture, in a heap, becomes spontaneously heated, but heat may be applied to it. The mass becomes transformed into a mixture of soluble sulphates and anhydrous silica. The sulphates are dissolved by hot water, which then contains the salts of nickel and magnesia and the iron partly as protosulphate. The iron is peroxidized by some known process, and then precipitated, preferably by milk of magnesia. Or the iron may be peroxidized by calcining the ore, before or after sulphatization, and if needful adding nitrate of potash or soda. The solution being separated now contains only salts of nickel and cobalt with magnesia, and, on heating it, sufficient milk of magnesia (emulsion of caustic magnesia) is added to precipitate all the nickel: "or an excess of magnesia may be used, and after "separation of the excess of liquid the precipitate may be "treated either with a solution of sulphuric acid or an excess "of a solution of the sulphates of nickel and magnesia, which "takes up all the excess of magnesia." The oxide of nickel remaining is reduced by ordinary methods to obtain metallic nickel. The solution of soluble sulphates obtained from the ore may be evaporated to dryness, and the residuum be calcined alone or with sufficient saltpetre to convert all the iron into insoluble peroxide separable by washing. The solution containing nickel (and cobalt) with magnesia may be treated as above described, or be evaporated to dryness and calcined with a mixture of saltpetre, magnesia, or carbonate of magnesia, sufficient to decompose the sulphate of nickel and reduce it to oxide. On washing the mixture, the oxide of nickel remains and may be reduced to metallic nickel. A continuous-reduction furnace for this purpose contains one or more vertical pots or tubes open at both ends, the upper end protruding above the furnace and being covered, while to the lower end is adapted an iron tube closed by a sliding door. The oxide and coarsely-pulverized charcoal are introduced at the top of the tube and, as the reduced metal is withdrawn at the bottom mixed with excess of charcoal, the charging is repeated, and so on continuously. A drawing shows a furnace with tubes descending through a space in communication with the fireplace.

Again, to the heated solution containing sulphates of nickel and magnesia (after separation of the iron) there may be added sufficient of a solution of caustic potash or soda or their carbonates to precipitate all the nickel (and cobalt) without magnesia.

Ores containing cobalt may be likewise treated.

[*Printed*, 6*d*. *Drawing*.]

A.D. 1877, February 20.—No. 700.

DUDGEON, ALEXANDER.—Application of asbestos for lining furnaces.

"Fire-resisting compounds of asbestos and silicates" may be thus prepared. Asbestos is ground (without clay or earthy matter) and mixed "in a solution of silicate of potash, silicate "of soda, stannate of soda, or other chemical substance "possessing similar properties." The composition is moulded into bricks, tiles, or other forms, and dried and burnt up to a high temperature. "Furnaces, cupolas, crucibles, or apparatus "for fusing metals" may be lined with such compounds.

[*Printed*, 6*d*. *Drawing*.]

A.D. 1877, February 22.—No. 725.

ABEL, CHARLES DENTON.—(*A communication from Frank Raymond*.)—"Composition alloys."

Metals or alloys may be melted and mixed with mica to prevent corrosion and render them more hard and durable and less susceptible to heat or friction. Mica may be placed with borax, saltpetre, or soda in the crucible or furnace containing the metal to be melted. "The borax, saltpetre, and soda will "cause the mica to melt, when it will mingle with the metal," producing the desired effect. The following "ingredients have "been compounded"; 1 part of lead, 1 of zinc, and 2 of mica; also 3 of brass, 1 of copper, zinc, and lead, respectively, and 4 of mica; also 4 of copper, 4 of mica, 1 of tin, and 1 of lead.

[*Printed*, 2*d*. *No Drawings*.]

A.D. 1877, February 24.—No. 765.

BOULTON, MATTHEW PIERS WATT.—Producing heat by the combustion of inflammable gases or vapours.

The heating of crucibles is included. Air may be conveyed on both sides of passages used for the supply of a mixture of gas and air, and, " mixing with the gas and air issuing from them, " supports combustion along with them." To produce intense heat, which may be greater than the walls of any furnace can resist, oxygen may be employed instead of air. There are chambers into which a mixture of oxygen and combustible gas is forced in suitable proportions, whilst into another chamber oxygen is likewise forced ; or the relative positions of the oxygen and the mixture may be reversed. They are led through annular passages, which may be formed in refractory material or may pass through a water casing. " The oxygen issues in an " annular jet, and on either side of it the mixture of oxygen and " combustible gas issues in an annular jet, directed so as to im- " pinge upon the central jet of oxygen. The stream of products " of combustion strikes down on the material," which is to be subjected to the heat and which is placed in the cavity of a basin formed of lime, wherein the products of combustion act and then, as they rise to a flue, mix with sufficient air to reduce their temperature. " To obtain still greater intensity of heat, " the gas which is used unmixed, whether this be oxygen or the " gas which is burnt with it, may be supplied in a heated " state."

[*Printed*, 10*d*. *Drawings*.]

A.D. 1877, February 24.—No. 769.

GIMSON, Edward.—Stone-breaking machines.

The working parts are enclosed within a strong rectangular framing, the ends whereof form two fixed vertical jaws with serrated surfaces facing inwards towards the centre of the machine. Facing the fixed jaws are two very strong movable jaws with like serrated faces. Each movable jaw hangs pendent from a transverse shaft extending across the upper part of the framing. Midway between these jaws, a vertical rocking lever is centred upon a transverse shaft extending across the lower part of the machine. An eccentric on a main transverse shaft gives rocking motion to the lever, and works in a deep brass or other metal block or bearing-piece, which moves vertically in a guide formed in the lever. The said block is made square, so that it can be turned and a fresh face presented when one face is worn. The

brasses or bearings of the main shaft, as well as those of the axes of the rocking shaft, are likewise arranged to effect economy. At the lower part of each movable jaw, recesses are formed to receive the outer ends of toggles, which practically form a set of adjustable stays for giving motion to the jaws. The inner ends of the toggles enter recesses in the rocking lever, and thus the latter imparts reciprocatory motion to each movable jaw and a double stream of broken stone is delivered, the size of it being regulated by the length of the toggle. The distance between the fixed and movable jaws may also be regulated by two tension rods, extending between the lower inner ears or angles of the movable jaws. The free ends of these rods are united by a right and left handed threaded nut, on turning which the threaded ends of the rods are brought nearer to or farther from each other. These rods also keep the movable jaws tight upon the toggles and rocking lever.

[*Printed*, 6*d*. *Drawing*.]

A.D. 1877, February 28.—No. 820.

PARNELL, Edward Andrew.—Obtaining metallic zinc.

Reference is made to the prior Specification No. 2950, A.D. 1868, which relates to a rotating calcining-tube.

Powdered blende or sulphide of zinc (especially the poorer ores) may be calcined preferably in a rotating cylinder (for which see the prior Specification), hot air entering the lower end of the cylinder instead of employing the gases from a fireplace, and the sulphurous acid disengaged being collected for making sulphuric acid. The calcination takes place at a moderate heat favourable to the production of sulphate of zinc, the sulphide being converted partly into sulphate and partly into oxide. To the calcined ore is added sufficient dilute sulphuric acid to unite with the oxide of zinc and form neutral sulphate, and thus a solution of sulphate of zinc (with little or no sulphate of iron) is obtained, which is separated from the residue and concentrated by evaporation. The sulphate of zinc may be calcined alone to obtain oxide of zinc (for the preparation of metallic zinc) and also sulphurous acid. But the sulphate is preferably mixed with a reducing-agent, most suitably with blende or sulphide of zinc, native or artificial. The sulphide in powder may be mixed with the concentrated solution of the sulphate, so that the zinc in

the sulphide may amount to about one-third of that in the sulphate. The partly-dried mixture is heated in a close furnace or oven, communicating with sulphuric-acid chambers, a dull red heat being ultimately reached. The product, consisting chiefly of oxide of zinc, is fit for obtaining metallic zinc by distillation with carbonaceous matter.

[*Printed*, 2*d*. *No Drawings.*]

A.D. 1877, March 1.—No. 829.

BRABY, Frederick, and MOORE, Arthur Charles.—(*Provisional protection only.*)—Galvanizing iron.

Refers to means for skimming the bath, deoxidizing-agents, and fume hoods. One or two slowly-rotated and partially-immersed rolls keep the chloride of ammonia or other deoxidizing-agent or zinc oxide from a narrow strip of molten surface through which the plate or other article is delivered. If one roll only is used, the other is replaced by a fixed strip. The deoxidizing-agents may be fresh or spent chloride of ammonia, or these may be replaced by the gaseous products of combustion from the heating-furnace, and the flux may also be economized by confining it to a narrow strip behind each roller by means of a partially-immersed plate. The fumes may be collected and removed by a hood, through doors in which the flux may be introduced, and when exhausted removed. The hood may cover the receiving or the delivery side, or both. If the latter, the parts are separated by a partially-immersed diaphragm. The plates or other articles are introduced or delivered through a slit provided with a trap door to prevent escape of fume, and are dried and warmed before and kept warm after immersion by the hot gaseous products. The articles are conducted beneath the bath by fixed or roller guides, and one or two simple flap or other safety valves may be used to prevent excess pressure in the hood or pipes leading to the condensor.

[*Printed*, 4*d*. *No Drawings.*]

A.D. 1877, March 2.—No. 853.

PARKES, Henry.—Obtaining nickel from ores and other substances.

The prior Specification No. 540, A.D. 1876, is referred to.

Finely-ground nickel ores, like those of New Caledonia, containing a silicate of nickel and magnesia with iron, are selected so as to contain about 10 per cent. of nickel in the bulk, and are mixed to a mortar-like consistency with concentrated sulphuric acid, with or without some strong nitric, hydrochloric, or hydrofluoric acid, or substances evolving such acids. There may be also employed with the sulphuric acid a solution of an alkaline hypochlorite, as of lime or soda ; or a current of chlorine gas may be passed into a more fluid mixture of acid and ore, or into water in which the ore is suspended and kept in agitation, thus forming a chloride soluble in water. The acid may be mixed with the ore on a stone or cast-iron floor, over which is a hood to lead the acid vapours evolved to a condensing-chamber. The mass obtained is broken up and thrown preferably into hot water, and the nickel salt dissolves. If the residue of the ore still contains nickel, it may be mixed and treated again with fresh ore, or " may be fused with other nickel compound to form " a sulphuret of nickel, and the nickel separated by " known methods. The solutions of nickel obtained as above described, after being freed from iron, magnesia, etc., if needful, may be treated to precipitate the oxide of nickel, which is reduced to a metallic state by the ordinary method.

New Caledonian nickel ores may be fused with (granulated) lead or zinc, or their oxidized compounds, and carbon and fluxes, " to " reduce the nickel or alloy with lead or zinc." Anthracite and fluorspar, lime, carbonate of baryta, or alkaline fluxes may be used. The alloy of nickel with lead or zinc may be run from the reverberatory or other furnace employed into water to granulate it ; or, being brittle, may be ground by rolls or edge-runners. The nickel is separated by dissolving the alloy in sulphuric acid, leaving the lead as an insoluble sulphate, or by calcining or oxidizing the alloy and dissolving in muriatic acid. Or, from the alloy containing zinc the zinc may be distilled as in the manufacture of zinc ; or the zinc may be separated by dissolving in acid.

To separate nickel from alloys with copper (preferably such as the prior Specification relates to), the alloy is cast into plates or other forms, which are used as the positive anode in a solution of sulphate of nickel or copper, containing a plate of copper as the negative anode. By magneto machines or voltaic electric currents the decomposition and deposition of the copper are

effected, and the nickel is separated as a bye-product, which settles to the bottom of the vessel with some impurities and may be refined as usual.

[*Printed*, 4*d*. *No Drawings.*]

A.D. 1877.—March 3.—No. 868.

TURNOCK, Joseph Rushton.—Pickling and swilling metal plates.

Alternately-working plungers are applied at the ends of the pickling or swilling trough to circulate the liquid. The trough may be of lead, wood, or iron, and rows of pins fixed in the bottom keep the plates vertical and apart, or a movable case may be used for the same purpose. The plates after removal from the pickling-trough are placed on a draining-ledge, before immersion in the washing-trough. The washing-trough may be in duplicate.

[*Printed*, 6*d*. *Drawing.*]

A.D. 1877, March 6.—No. 902.

WRAY, Cecil, and WRAY, Leonard, junior.—Alloy for thermo-electric batteries.

Iron, preferably cast iron, in a finely-divided state is to be incorporated with the brittle metals, antimony and zinc, usually employed in forming thermo-electric bars, the hardness, strength, and infusibility of which are thereby increased. From 1 to 5 per cent. of iron is the general porportion.

[*Printed*, 6*d*. *Drawing.*]

A.D. 1877, March 14.—No. 1013.

AITKEN, Russel.—Metallurgical furnaces.

"Within the body of the furnace and around or in close " proximity to the bed" upon which the metal, ore, etc. is melted or treated, there is formed a trench or hollow filled with gas-yielding coaly matter, to which, when fully ignited, air is supplied at the top, the entry of air beneath it being prevented. " The gas distilled from the fuel is burnt by the air forced into " the furnace to mix with it, and an intense heat is developed. " At the end of the operation the residuum is drawn out."

The firebricks composing the furnace are durable notwithstanding the heat, as the "ash of the fuel is not disturbed by "the blast or brought into contact with the more highly "heated parts of the furnace." The air employed may be heated by the products of combustion or otherwise.

Drawings show different arrangements of furnaces, in which fuel trenches and melting beds, hearths, or pots are arranged under one or more arches or under a dome. The fuel in the trenches may be first ignited by throwing ignited fuel on the top of it, and afterwards air is forced into the furnace through pipes and perforated bricks. Doors and openings are provided to give access to the trenches and beds, and for the exit of the waste gases. In one case four trenches intercommunicate, and the gases therefrom pass to a hearth, where additional air is admitted. In another case trenches surround a rising and falling platform, which carries melting-pots.

[*Printed*, 6*d*. *Drawing*.]

A.D. 1877, March 14.—No. 1021.

CROWTHER, Clement, MORGAN, Thomas Millington, and MORGAN, Jabez.—(*Provisional protection only.*)—Coating plates of metal.

The pickled and washed plates are dried in a hot-air chamber, then immersed in a bath of chloride of zinc, and re-dried, after which they pass direct to the coating-pot, or are first placed in a grease pot. The plates are guided in the coating-pot by levers to an immersed cradle in which they are kept vertical, and raised by levers or screws to the finishing-rolls, through which they pass lengthwise to obtain uniform coating. Beneath each roller hangs a chambered trough for surplus metal, heated by hot blast. The rolls are driven by worm gearing.

[*Printed*, 2*d*. *No Drawings*.]

A.D. 1877, March 17.—No. 1083.

BROMILOW, John.—Regenerative heating-apparatus.

An arrangement of flue valves, for reversing currents of gases and air for combustion and directing them through passages or regenerative chambers, comprises, "in the case of "each set of four passages, two pairs of valve seats; and a "single duplex conical or spherical valve acts for each pair of

" seats, closing downwards against the bottom valve seat when " lowered, and upwards against the top one when raised. The " flues, communicating with the furnace " to be heated, " proceed from between the valve seats. The space above the " upper seats communicates with the gas or air inlet, whilst " the space below the lower seats communicates with the " chimney." The valves, which consist of hollow castings, are suspended by chains from the opposite ends of a two-armed lever, which is connected to a weighted lever to keep the raised valve against the top valve seat, the valves being reversed by turning over the weighted lever. Again, the suspending-chains may be led over pulleys to a single-armed lever, and they are long enough to allow the lowered valve to rest freely on the bottom valve seat. Any valve or seat can be easily removed and replaced through doors in the valve box. Escape of gas direct to the chimney and admixture of waste gases with the fresh gas are avoided, while the passages for the waste gases are not contracted.

In " regenerative chambers containing chequered brickwork " for absorbing the waste heat from a furnace," the flues are to pass from the furnace to the bottoms of the chambers, so that the heated gases ascend, instead of descend, through the brickwork. Thus also the gases have longer flues to traverse before reaching the brickwork, and, if any melting then takes place, the melted matter will fall away from the brickwork (instead of choking it) and may accumulate in pockets for a long time without the chambers having to be cooled down. A drawing shows the application of these chambers to a steel-making furnace.

The invention also relates to a blast (or gas, under pressure) heating stove, which is described in the Abridgment Class *Manufacture of Iron and Steel.*

[*Printed*, 8*d*. *Drawings.*]

A.D. 1877, March 19.—No. 1095.

WALKER, Robert, and WOOD, Sam.—(*Provisional protection refused.*)—Tinning wire.

Consists in first passing the wire through a solution of blue vitriol and then through an amalgam of mercury and tin.

[*Printed*, 2*d*. *No Drawings.*]

A.D. 1877, March 20.—No. 1106.

LAKE, William Robert.—(*A communication from George Henry Moller, William Moller, and William Alexander Stephens.*) —Roasting ores.

The ore may be charged by means of shoots into a roasting-oven, where it is desulphurized and otherwise purified in a thin layer. The oven rests on hollow supports above a blast furnace, the gases from the upper part of which pass through the supports into the oven, air entering round the bottom of the latter to aid in the combustion. The oven has a scraper or partition to separate successive charges of ore placed therein, and a door gives access for stirring up the contents and removing dèbris. A central trap or hinged door allows the hot roasted ore to be discharged through the bottom of the oven into the blast furnace beneath. The oven is fitted with regulating-valves.

[*Printed* 6*d*. *Drawing*.]

A.D. 1877, March 21.—No. 1116.

BRAIN, William Blanch.—Separating iron and other metals from their ores.

In constructing electric batteries, " various ores, metallic " oxides, acids, or salts are arranged " so as " to form triple or " multiple elements according to the nature of the metals to be " separated from their ores." The separation of iron is described as an example. The outer element of a cell may be a wrought-iron vessel, within which is placed a porous pot (or a flannel or equivalent bag, saturated with paraffin wax), and within this is placed a like pot (or bag), smaller but equal in depth. The inner pot contains a plate or other form of carbon, and also an oxidizing-agent, such as a mixture of nitric, sulphuric, and chromic acids, or of chlorate of potash and hydrochloric acid. The space between the two pots contains red or brown hæmatite iron or other metallic oxide, and hydrochloric acid or " chloride " of ammonia " or both, the acid being thus incorporated with the ore. The vessel outside this pot contains water, with or without acids or chlorides. Metallic connections are secured to the carbon and the iron vessel. " On applying a connection to " the middle element of iron or other ore," with which may be mixed pieces of carbon to increase the conductivity, a current of electricity passes. Provision may be made for drawing off the

chloride of iron, after which there is added " a fresh supply of " hydrochloric acid and ammonia, and so on." Heat may be applied to the cells to increase the action. For working under pressure, the cells may be sealed down with non-conducting materials, tubes being provided to admit acid, and valves to regulate the pressure. More than a triple element may be made by using additional porous pots or diaphragms, and " ores of " iron or other metals of higher or lower electro-negative or " positive characters incorporated with suitable acids."

[*Printed*, 4*d*. *No Drawings.*]

A.D. 1877, March 22.—No. 1140.

VERKOUTEREN, Adrian John.—(*A communication from William Smith Sampson.*)—Calcining-kilns.

Furnaces or kilns, employed for roasting ores etc., and fitted with one or more fire-chambers and ashpits in the circumference near to the base, may be provided with a centrally-suspended draught flue, so that the heat, gases, and flame may be drawn from the fire-chambers through the charge of ore towards the centre of the kiln and escape through the flue. The flue is made tapering from its apex to its base, and is provided with longitudinal flanges or projections, with or without returning flanges. It may be made in sections, and it contains openings for the passage of the gases etc. Owing to the tapering form of the flue, the charge falls away from it in descending through the kiln. With the flue is combined a smoke stack or chimney, provided with a damper for regulating the draught. The drawing shows " draw doors " at the base of the kiln. The arrangement ensures more regular combustion and gives better control over the fires.

[*Printed*, 6*d*. *Drawing.*]

A.D. 1877, March 23.—No. 1143.

WEBSTER, James.—Alloys.

Alloys may be produced suitable, with or without the admixture of other metals or alloys, for casting cannon and other large articles, and also for ingots etc. for rolling and general purposes To make a " hard bismuth bronze or alloy," 1 part by weight of bismuth, 3 of lead, 6 of zinc, 15 of nickel, 25 of copper, and 50

of antimony are melted and thoroughly amalgamated in a pot or crucible. The resulting hard alloy may be made into reflectors and other articles requiring a high polish or hardness, and also into bearings, valves, etc. It may be ground and used as a bronze powder. A softer bronze is made from 1 part of bismuth, 5 of lead, 12 of zinc, 30 of nickel, and 52 of copper. These alloys resist oxidation, and keep their colour better than similar alloys hitherto made. The proportions of the ingredients may be varied. Thus, for the said soft bronze an additional ½ to 1 part of bismuth may be used, "taking the same quantity from the "zinc," when certain large castings are to be exposed to sea water or acid fumes. The claims include "the using or mixing "of the metal bismuth or its chemical compounds in the "manufacture of bronze" or metallic alloys.

[*Printed*, 4*d*. *No Drawings.*]

A.D. 1877, March 26.—No. 1178.

CADDICK, David, and MAYBERY, Joseph.—Puddling, heating, melting, and other furnaces.

The combustion chamber, which acts as a gas producer, is constructed of firebrick, enclosed in a double or inner and outer iron casing. Air enters or is forced into the space between the two casings, and, becoming heated by contact with the inner casing, passes through passages into the combustion chamber. Some passages lead into the chamber on a level with the fuel, or into a closed ashpit below the firegrate, and the air thus entering burns the fuel to produce inflammable gases, while other passages terminate above the fuel, and the air thus entering mixes with the said gases and produces flame, which passes from the upper part of the combustion chamber through a large throat into the bed part of the furnace and acts on the metal therein. Valves regulate the supply of air. The outer casing contains sight-holes for observation and for clearing the said passages. The air checks the radiation of heat from the combustion chamber.

"There may be several furnace beds arranged round one such "producer, a throat therefrom being provided for each of "them."

[*Printed*, 6*d*. *Drawing.*]

A.D. 1877, March 29.—No. 1244.

BURNS, David.—Dressing ores.

A separator or hotching-machine comprises, say, 3 boxes, arranged one higher than another in line, and each communicating with its lower neighbour by the adjoining side being made lower than the other sides, thus allowing superfluous water with the lighter and worthless particles to flow from box to box. These particles deposit themselves according to their specific gravity in distinct boxes, wherein they are further cleansed, and finally the refuse passes into a launder. A perforated plate or sieve divides each box horizontally into an upper shallow compartment, to receive the crude ore, and a lower deep and conical compartment, from which on opening a valve at its bottom the dressed ore falls into a receptacle beneath. A pipe or chamber extends along the side of the boxes, and communicates with each box separately by an aperture controlled by a valve which is actuated from a cranked shaft. Water under pressure is supplied to the chamber, and, as the shaft revolves and opens the different valves successively, a stream of water is admitted to each box in turn with a pulsative action. The water, rising upwards and percolating through the sieve, displaces the superincumbent mass thereon and carries with it the sludge and lighter particles to the next lower box, where they are likewise treated. When the valve shuts and arrests the stream of water, the heavy particles fall through the sieve to the lower compartment, where they may be met and again washed by a succeeding stream of water when the valve is reopened. A vessel containing compressed air may be fixed on the water main when pumping-machinery is employed.

[*Printed*, 6*d*. *Drawing*.]

A.D. 1877, March 29.—No. 1255.

LAKE, William Robert.—(*A communication from Robert Loudon Walker.*)—Furnaces.

The invention, the application of which to a furnace for heating or melting metals is described with reference to drawings, relates to the use of two separate fireboxes, so arranged with flues and dampers that the products of combustion from either firebox may be caused to pass through the other. The latter will contain at the time a mass of glowing fuel, so that the

products of imperfect combustion from the former will be perfectly consumed by the aid of a supply of air. According to the drawings, on each side of the hearth (whereon the metal is placed) is situated a firebox within a flue which surrounds the hearth and communicates with it at one end. The products of combustion from the firebox freshly charged with fuel pass through the flue and the other firebox into and over the hearth and up the chimney. When fresh fuel is put into the last-mentioned firebox, the arrangement is reversed by means of two dampers.

[*Printed*, 6*d*. *Drawing*.]

A.D. 1877, April 3.—No. 1290.

GORMAN, WILLIAM.—Metallurgical furnaces and processes.

Coal (or wood or other carbonaceous matter) may be treated in an upright main chamber, having a charging-valve at the top. Air (by preference highly-heated) is passed in at the top and down through the mass of coal, so that any hydrogen gas and sulphur present are burnt and produce heat for expelling volatile matters, which (including sulphur) are more effectually removed than usual. Coal is supplied at intervals at the top and the coke produced may be removed at the bottom, above which level the gases are withdrawn, the chamber being deep enough to ensure that the oxygen of the air is converted into carbonic oxide. Thus the solid and gaseous parts of the coal are obtained for separate use. Again, all the combustible parts of the coal may be converted into permanent gases, suitable for reducing ores or for heating regenerative or other furnaces (without depositing tar or carbon if conveyed to a distance). In this latter case a deep chamber is provided, so that, by supplying air at the bottom, carbonic oxide may be produced (by means of a partial combustion of the solid carbon by the air ascending through the coke) and mixes with the gases descending from the upper part of the chamber. The said chamber may be connected to another upright chamber for reducing ores, the gases passing from near the bottom of the former to near that of the latter chamber, and ascending amongst the ores therein. Thence the gases may pass to other chambers for calcining ores etc. Also blast-furnace gases may be employed for reducing or calcining; in the latter case the gases are com-

pletely burnt and the apparatus may be open at the top like a lime kiln. The gases may be introduced through an annular flue and connected openings, and air for combustion through bottom doors or otherwise. The hot gases, after being used for reducing ores, may be revived by passing through heated coke (to convert the carbonic acid present into carbonic oxide) and then used for heating reverberatory furnaces. Ores may be charged first into a calcining-chamber, next into a reducing-chamber, and afterwards into a smelting-furnace or hearth. Reducing-chambers may be combined with puddling or steel-producing furnaces, so that the reduced ores are conveyed direct to the latter. To produce metal direct from the ore, coking and reducing chambers are placed at a higher level than a working or fusing hearth, and, when the ores are reduced and the coal coked, they descend to the hearth in such a way that the reduced ores are surrounded by hot coke, upon which jets of air are projected to produce heat for welding or smelting the reduced metal. The arrangement of coking and ore chambers may be modified, and the furnace may be adapted for fusing metals, the latter descending to the hearth from chambers in which they are heated by burning therein the gases from the coking-chamber. Sometimes the fuel, ores, and flux are charged into the same chambers and throughout treated together, there being a subjacent hearth to receive the materials from the chambers.

Sometimes gases from the coking or reducing chambers are injected into the tops of the coking-chambers by a jet of air to produce heat by combustion. This allows of non-bituminous coal, coke, or wood being advantageously used in such coking-chambers as above referred to.

[*Printed*, 10*d*. *Drawings*.]

A.D. 1877, April 6.—No. 1346.

WALBRIDGE, Wells David. — (*A communication from Nathaniel Shepard Keith.*) — Recovering tin from scrap tin plate.

The scraps of tin plate, in a separated and extended condition, are conveyed through an electrolysing-bath in a vat or tank by means of an endless-chain conveyer or some substitute therefor, (a cage or basket, revolving or not, being used for small scraps).

The bath preferably consists of a solution of caustic and nitrate of soda or potash, or of caustic soda and chloride of sodium, and should not attack the iron of the scraps. A current of electricity from a battery is passed through the bath, the endless chain and the scraps acting as the anode, and the vat (if formed of iron or equivalent conducting-substance) as the cathode ; or metal plates may be suspended in the bath on both sides of the chain, with or without a division plate between the entering and receding portions of the chain, to act as the cathode. The bath is heated preferably to about its boiling point by externally heating the vat, or by immersing a coil of steam pipe therein. During the immersion of the scraps, the duration of which is determined by the speed of continuous or intermittent movement of the chain, the tin is dissolved "and separates at the " cathode, and it is deposited in the vat in the condition of " crystals of metallic tin." The tin thus recovered may be metallurgically converted into block tin. Sometimes the scraps may be immersed in the vat by means of a rack or frame, which after a time is withdrawn therefrom. The claims are limited with reference to what has been previously proposed or done of a somewhat analogous character.

[*Printed*, 6*d*. *Drawing*.]

A.D. 1877, April 6.—No. 1358.

WHITEHOUSE, Daniel.—Manufacture of tin and terne plates.

Relates to a cage and turntable for use in pickling and swilling iron plates. The plates are supported in a vertical position on transverse bars, and kept separate by copper rods the ends of which rest on supporting bars. To assist in supporting the plates and prevent the deflection of the copper rods, upright taper pieces may be fixed to the transverse bars. The bars supporting the copper separating-rods are attached to lifting-rods by a fork and swivel, and may be moved upwards and downwards as desired.

A turntable supporting four cages is used in conjunction with a crane and the pickling and swilling troughs.

[*Printed*, 8*d*. *Drawings*.]

A.D. 1877, April 12.—No. 1440.

HALL, CHARLES EDWARD.—Breaking stones etc.

The invention relates to machines having two or more vibrating jaws hung upon the same fulcrum or shaft, and especially to those comprised in the inventor's prior Specification, No. 1613, A.D. 1876.

When the wearing-faces of the jaws consist of alternate V-shaped ribs and furrows, such stones as fall into the furrow produced by the inclined faces of the ribs or teeth at the adjacent edges of adjacent jaws (which move in opposite directions) rock about and are less readily crushed. To prevent this, the teeth or ribs at the edges of each jaw are made flat, so that the adjacent teeth of each two adjacent jaws shall present flat surfaces, which crush the stones at once. When the faces are in upper and lower sections, one or both sets may have flat teeth at the edges.

A surfacing-machine described may be partly used for trueing the backs of the jaw faces above referred to. A shaft, carrying driving-pulleys and an emery wheel, revolves in a headstock fixed upon the bed-plate of the machine. The jaw face to be ground by the periphery of the emery wheel is fixed on a table beneath the wheel. The table is supported on inclined sliding blocks, which are made to approach or recede from each other by a screw engaging with screw boxes in the blocks, and thereby to raise or lower the table for fine adjustment. Thus the necessary "feed" is put on when the table is traversed under the wheel.

The invention also relates to grinding-mills etc.

[*Printed*, 6*d*. *Drawings*.]

A.D. 1877, April 14.—No. 1465.

HOLLWAY, JOHN.—"Production of silicides of metals and "silicides of metallic alloys."

By a process similar to that to which the inventor's prior Specifications Nos. 1446 and 3314, A.D. 1876, and No. 265, A.D. 1877, relate, there may be produced a metallic coke, intended for the manufacture of silicides by smelting the coke, with or without additional metalliferous and silicious substances and ordinary coke, and provided that the silica present is in excess of the alkaline and earthy bases. The coke is formed from

metalliferous ores or other substances, coal, and sometimes bitumen, and additional silicious substances, when needful, which are washed or otherwise purified, if desired, and mixed together. The excess of carbon in the coke and the intimate admixture effect the reduction of the silica and the production of the silicide. Sometimes the mixture is formed into lumps and smelted without being previously coked.

[*Printed*, 4*d*. *No Drawings.*]

A.D. 1877, April 16.—No. 1488.

BAZIN, Ernest.—Washing auriferous sands and other materials.

In separating matters of different densities, an immersed circular rotative washer effects under water or other liquid the expulsion of the barren matters by centrifugal force. The washer may comprise "a spherical cap forming pans (or basins) " which are more or less hollow," hemispherical pans, hemispherical pans extended upwards by a cylindrical part, and a half ellipsoidal form being included, and also circular plates, flat, convex, or concave. The washer may be covered with woollen material, cloth, caoutchouc, or india rubber, placed circularly as in strips, to oppose the escape of rich but thin or fine matters. A denser liquid, such as mercury, may be used together with water. One or more washers may be completely immersed in a round or rectangular tub of water. The pan is fixed on a hollow axis, in which fits a pivot rising from the bottom of the tub, as shown in a drawing, and which extends out of the water to receive a double crank or handle for rotating the pan. The washer may have a dividing-hopper and distributor, water being also admitted to the divider. By the simple deposit of auriferous sand upon the bottom of the pan, the sand may lose at once 50 per cent. of its weight, while the gold may only lose one-nineteenth of its weight. By slight alternate shakes the sand is evenly distributed and becomes circular. Rotation is then imparted to the pan and therefore to the sand. As the water does not immediately gyrate, it offers a resistance, and extends, classifies, and prepares the sand for the expulsion. On accelerating the rotation, the matters are projected from the centre to the circumference of the pan, but the light and barren matters alone should mount up the increasingly-steep curve of a spherical pan and fall outside of it, the speed of rotation being

regulated accordingly. There may be a bunghole near the bottom of the tub for removing the matters expelled from the pan, which may have a false bottom to be raised for collecting the residual rich matters. Means may be taken, as by using a rectangular tub or by reversing the direction of rotation of the pan, to check the tendency of the water to be drawn round after a time. A washer may also comprise two superposed pans, a smaller one above a larger, which receives the matters rejected by the smaller and separates the rich matters which have escaped therefrom. Again, on the axis of the pan may be mounted a rake, which has teeth fixed upon branches and inclined in different directions. A lever controls the rake. When a flat plate with a woollen or like covering is the washer used, as for gold scales or dust, it may be rotated by bevel gearing beneath it. Mercury may be placed in the pan. The matters then fall to the centre of the mercurial mass and are caused to traverse its surface by the centrifugal force, amalgamation and separation simultaneously taking place.

[*Printed*, 6*d*. *Drawing*.]

A.D. 1877, April 16.—No. 1491.

HARRIS, George Hicks, and ROUNSIVELL, William.—Crushing ores etc.

The stamp head of a stamper is constructed of an annular or hollow cylindrical form, or of a segmental or other suitable form, containing one or more orifices or indents, through which the ore, with or without water or other liquid, is introduced to the stamping-face. The stamp head may or may not have a renewable face in one or more pieces. It may be actuated by one or more stamp bars or lifters. Any desirable weight of head may be used ; the larger and heavier it is, the more effectually it will operate, for the ore being presented at the internal edge of the face is compelled to pass under it before escaping. All the water employed is utilized for washing away the stamped particles. The annular head, when used singly in a coffer, admits of the largest grate area, as it can be entirely surrounded by grates. Other advantages are mentioned. Sometimes a cylinder may be used, to which the stamp heads are secured by a ring, lifters actuating the cylinder. A "stamper" may be provided with any desired number of the stamp heads.

[*Printed*, 6*d*. *Drawing*.]

A.D. 1877, April 19.—No. 1518.

FRYKMAN, Axel Gabriel.—Metallurgical furnaces.

The furnaces consist of a "heat producer" or a gas generator, communicating with a vertical, horizontal, or inclined "fire-room "in which the matters are heated or melted," and the gases escaping from the fire-room are employed to heat a blast-heating apparatus. The "heat producer" consists of a vertical shaft, with a feeding-hopper at the top and a slag hole at the bottom. Fuel is introduced with substances to remove volatile impurities and produce a fusible slag. Hot blast is applied through distributing-pipes, and its pressure and the thickness of the fuel are so maintained as to effect "a complete or regulated com-"bustion" with an oxidizing, neutral, or reducing flame, which is utilized in the "fire-room." Heated gases from the fire-room are also conveyed to the feeding-hopper, which may be divided into compartments, of the heat-producer, to heat and prepare the fuel therein by driving off certain undesirable gaseous substances. The gas generator, when used, has an analogous construction, but the thickness of the fuel is regulated to effect an incomplete combustion. The heated combustible gases so generated are subsequently completely burnt by introducing a hot blast into the flue leading to the fire-room. Thus an intense heat is economically obtainable.

Heating and melting furnaces are described. One furnace comprises a "heat producer," combined with a vertical melting "fire-room," which is provided at the top with a charging-hopper and exit flues, and which communicates at the bottom with a reservoir for the molten matters. A separate heat-producer is attached to this reservoir, and "the gases of this com-"bustion" also enter the fire-room. Again a heat-producer may be combined with a horizontal fire-room, which according to a drawing appears to contain crucibles. Another furnace has a gas generator combined with a vertical shaft or fire-room of the shape of a cupola. In this furnace melting is effected by the complete combustion of gaseous fuel by means of a blast. Metal fused in these furnaces may accumulate and undergo some refining treatment in receptacles belonging thereto. The blast-heating apparatus is described. It comprises two accumlating belt pipes, communicating with heating-pipes for the blast, and india-rubber or leather pipes compensate for expansion.

[*Printed*, 1s. *Drawings*.]

A.D. 1877, April 21.—No. 1563.

MAYER, Erhard Ludwig.—Separating silver from cupreous solutions.

Solutions, such as are obtained by lixiviating calcined cupreous pyrites, may be placed in a mixing-tank, having a mechanical stirrer which is set in motion. There is then added a solution, containing glue or analogous nitrogenous substance (albumen and isinglass being mentioned) and an iodide (as potassium iodide) or other suitable compound of iodine, whereby a chemical compound of silver, glue, and iodine, is precipitated. After thorough mixing, the liquor is transferred to a settling-tank, and in about an hour the greater part of the said compound settles to the bottom. The liquor is then drawn off at a point about one foot above the bottom of this tank, and conveyed to a larger settling-tank, where an infusion or solution, containing tannin, galls, sumach, or analogous astringent principle, is added chiefly to hasten the precipitation of the rest of the said compound. After from 1½ to 2½ hours the liquor is drawn off at a point 1½ or 2 feet above the bottom of this tank, and, being practically free from silver, can be treated to separate the copper as usual. The said precipitates may accumulate for a week or so while fresh quantities of liquor are treated, and are afterwards conveyed to a tank with a perforated bottom, which is 2 or 2½ feet above the actual bottom and is covered with iron ore or other filtering-material. Dilute acid is repeatedly pumped or run through the precipitate until all copper salts are dissolved. When the acid no longer acts rapidly on the precipitate, it is used for lixiviating calcined pyrites, and the precipitate is treated with fresh acid. The washed precipitate, now containing chiefly lead and lime salts besides the said compound, is placed in a drum, which is slowly turned about its horizontal axis after any free acid has been neutralized by slaked lime (or otherwise) and a solution of sulphides, preferably that obtained by lixiviating oxidized alkali waste, has been subsequently added. Thus the sulphides in solution are replaced by sulphates, chlorides, and iodides, and this solution can then be used, instead of potassium iodide, for precipitating silver with the aid of glue. Fresh sulphide solution is put into the drum and the process is repeated until all the iodine has been recovered as soluble iodide. Afterwards the precipitate, now consisting chiefly of sulphides of heavy metals, may be smelted

or otherwise treated to recover the silver as metal, which will contain lead and part of the gold of the cupreous solutions.

Highly-concentrated cupreous solutions may be used, the precipitates containing silver can be quickly separated, and the loss of iodine is comparatively slight. Proportions of glue, iodine, and tannin are mentioned for use with a particular cupreous solution, to which the description given specially applies.

Blood or glutin might be the nitrogenous substance employed.

[*Printed*, 4*d*. *No Drawings.*]

A.D. 1877, April 26.—No. 1633.

MAURICE, Arthur Hill.—(*Provisional protection only.*)—Cleansing and separating metallic ores, minerals, and metals from other matters and impurities.

Within a cylindrical or conical tub or barrel there revolves a vertical spindle, to which at intervals from the bottom to the top there are attached arms or vanes, fixed radially and horizontally, extending to the side of the tub, and set at a convenient angle (as of 45°) to the perpendicular. The materials for treatment, being placed in the tub with water, are forced to mount from the lower part of each vane to the top edge, and then fall again behind the vane to their former level. Thus the particles with a higher specific gravity fall most quickly in the water and are gradually worked down to the bottom of the tub. The materials arrange themselves in the order of their specific gravity, the lightest being at the top of the tub. Afterwards the impure and lighter matters are removed through valves, and the heavier ores etc. in the same manner.

In auriferous ores, the finest particles of metal will be separated, and the gold be brought into continual contact with mercury placed at the bottom of the tub, the resulting amalgam being removed through valves after the overlying impurities have been drawn off.

[*Printed*, 2*d*. *No Drawings.*]

A.D. 1877, May 2.—No. 1701.

ROBBINS, Edwin.—(*Provisional protection only.*)—Refractory materials.

In connection with the making of firebrick, the use of the following refractory and binding or fluxing materials is referred to :—Quartz, silex, pottery, soluble silicate, Cornwall china stone, Jersey china stone, Middleton Hill stone, felspar, fluorspar, alkalies, pulverized glass, iron ore, pumice stone, boracic acid, sandstone, millstone grit, fire-stone, gannister, silica etc., slate, fire and other clays and fired clay articles, potters' seggars, salt-glazed wares and such as made from Dorset and Devon clays, earthenware, china and parian, broken pitchers, glazed or not glazed (all these having been fired up to a white heat), silicate of soda or potassa, or silicate with a small percentage of lime, Portland cement, plaster of Paris, oxide of zinc, or magnesite, with its chloride, sulphate of lime or of baryta, argillaceous carbonate or caustic lime.

In making Dinas bricks etc., the inventor requires "about " four per cent. only of silicate, Jersey or Cornwall china stone, " with or without lime," and uses "the silicate and other " vitrifiable materials," utilizing refuse of potteries, brick-fields, etc. If the materials are too vitreous, more sand or the like is added. If great pressure be employed in the manufacture, less flux is used. Farinaceous or other viscous mucilage may be employed.

" Manganese, with or without admixture, may be used as a " liquid wash, employed for lining of hearths, interiors of " furnaces, melting and other vessels. Anthracite or mineral " charcoal, stone-coal, or shulm" will aid vitrification, and cause the mass to better withstand expansion and contraction on heating and cooling.

[*Printed*, 6*d*. *No Drawings.*]

A.D. 1877, May 3.—No. 1721.

COULSON, MATTHEW, and HENDERSON, WILLIAM.—(*Provisional protection only.*)—Crushing lead and copper ores etc.

One or more cast or wrought iron or steel (chilled or otherwise) or wooden rollers, having plain, toothed, fluted, or chequered surfaces, are conveniently arranged to work into a concave or segmental jaw or jaws, made of like materials, and having plain or other surfaces. This machine is mounted in a framework adjustable by an arrangement of screws and india-rubber or other springs or levers and balance weights, so that the

ore may be crushed to any required size. The rollers, which receive motion from a main shaft and gearing, are arranged to work either within or outside of a series of plain or other secondary plates or cylinders, which may be made entire or formed in segments, arranged vertically, horizontally, or otherwise, and either stationary or movable.

[*Printed*, 2*d*. *No Drawings.*]

A.D. 1877, May 5.—No. 1759.

EVERITT, William Edward.—Treating molten copper to prevent unsoundness of castings.

Shortly before removing melted copper from the furnace or after its removal, the inventor introduces into the melted metal a quantity of cyanide of potassium, which is stirred for a short time with the melted copper before the latter is poured into the mould. Other fusible cyanides or compounds, which by contact with the molten copper yield a fusible cynanide, may be used, cyanide of sodium and yellow prussiate of potash being mentioned.

[*Printed*, 4*d*. *No Drawings.*]

A.D. 1877, May 7.—No. 1767.

SMYTH, Samuel Richard.—Metallurgical furnaces.

As improvements upon the prior Specifications No. 3840, A.D. 1874, and No. 3353, A.D. 1875, in the furnaces for heating, puddling, etc., the inventor forms "the hearths and furnaces of "an oblong shape" to obtain increased space for the metal, while allowing of a form of ladle bottom which will secure economy of fuel and not unduly increase the width of the framework. A hydraulic drawing-out cylinder, fixed in a pit behind the furnace, may be employed for running the movable truck ladle bottom into and out of the furnace, in front of which is another pit to receive the ladle bottom.

Round the dam of the vacuum furnace is applied a circular chamber or belt, for supplying purifying-agents by the aid of a blast, and provided with tuyères or openings in communication with the dam. Purification and refinement of iron may be effected by like means when applied to blast, cupola, air, or other melting-furnaces. In front of a smelting-furnace may be

constructed a domed dam to receive the metal for such further treatment.

[*Printed*, 10*d*. *Drawings*.]

A.D. 1877, May 7.—No. 1770.

JOHNSON, JOHN HENRY.—(*A communication from Auguste Séguin.*)—Metallurgical furnaces.

The products of the combustion of gaseous fuel may pass through a flue to a welding-furnace with refractory sole, whence they pass to a re-heating furnace. A channel is provided between the welding and re-heating furnaces for running-off scoriæ. These furnaces are also separated by a hanging bridge, and access is obtained to them by separate doors, the whole being encased in sheet iron strengthened by angle irons.

Coal is distilled in a separate chamber, combustion is effected in a specially-constructed combustion chamber, and heated air is supplied to mix with the gases at the hottest point, thereby burning all smoke. The upper part of the distilling-chamber is conical, and is provided with a charging-hopper. Water chambers are provided round the lower part and under the bottom of the distilling-chamber. Air is supplied thereto under pressure and passes through an inclined step-grate, at the lower part of which is a movable and adjustable grate. The carbonic oxide gas here generated passes to the combustion chamber, where it is mixed with air which has been heated by traversing winding passages formed by hollow bricks around this chamber. A bright white heat is obtainable.

[*Printed*, 6*d*. *Drawing*.]

A.D. 1877, May 12.—No. 1849.

DAVIS, DAVID.—Furnaces.

The following improvements are applicable to balling-furnaces.—A furnace, which according to drawings is of the reverberatory-furnace type, is constructed for burning anthracite or bituminous coal, and has a closed fire-chamber with doors for cleaning the firebars. The stoke-holes also have doors when anthracite is used. Blast is supplied to the grate, and branch pipes pass through the top of the furnace for conveying blast to aid combustion of the gases on entering the body of the

furnace, or for admitting steam from a boiler heated by the waste heat of the furnace. Steam is also introduced into the neck of the furnace to assist the blast. The firebridge is hollow, and the furnace is provided with cooling-boxes. There are side doors and tapping-holes, the cast-iron bottom employed being somewhat higher at the centre than at the sides. Air circulates in the open space under the body of the furnace, and a stream of water is directed under the same to keep the bottom cool.

[*Printed*, 6*d*. *Drawing*.]

A.D. 1877, May 14.—No. 1885.

HART, Benjamin Woolley.—(*Provisional protection only*.)—Dressing ores.

By this invention, which is described with reference to iron ores, the associated mineral impurities are mechanically separated from the crushed ore by "the process analogous to that "usually known as 'jigging'; but in machines wherein air is "the medium employed for the separation, which takes place "according to the respective specific gravities of the minerals "associated."

[*Printed*, 2*d*. *No Drawings*.]

A.D. 1877, May 15.—No. 1889.

DOWSON, Joseph Emerson.—(*Provisional protection only*.)—Furnaces for treating ores.

To a hollow shaft or tower, vertical or nearly so, are attached near the bottom preferably two calcining or reverberatory chambers, side by side, separated by a partition wall, and with dampers at each end; also one or more fires or gas generators, the flues from which are so built up against the shaft that the heated gases and air ascend to near the top of the shaft, into which they then pass through an opening, and by a regulated draught are drawn down the shaft and passed under or over the floors or along the sides of the calcining-chambers into a condensing-tower or directly to a stack. Pulverized ore is showered down the shaft, but, to lessen the velocity of its fall and ensure the presence of sufficient oxygen to effect the changes desired in the state of the metals, blasts of air are forced into the shaft in a horizontal, upward, or downward direction and, if

needful, into the calcining-chambers. The said blasts should be first heated, for which purpose air passages may be formed beneath the floors of the said chambers and in the walls of the shaft or partly in the flue leading from the fires. The roasted ore, falling to the bottom of the shaft, is raked down into one or more calcining-chambers, which may sometimes have an additional fire, and there further roasted or treated as required. The chambers may have one or more floors with an enclosed space beneath, into which the finished ore can be raked through holes in the floor, and there kept hot and dry till required for lixiviation or other treatment.

[*Printed*, 2*d*. *No Drawings.*]

A.D. 1877, May 15.—No. 1892.

JENKINS, James.—Cleaning metal plates.

Relates to a mode of and appliances for removing oil and grease from tin and terne plates after they have been coated or tinned. One or more barrels (preferably vertical) of wood, metal, or other material are revolved by the driving-pulleys in bearings, which are adjusted towards each other by screw spindles working in travelling nuts and operated by hand with a strap and pulleys. Casings filled with bran, sharps, sawdust, or other cleaning-material enclose the barrels and have a slit on opposite sides through which the plates are passed, guides being if necessary used in front of the slits, and feed rollers can also be used for feeding the plates through. The surfaces of the barrels are preferably grooved or fluted, some flutings being straight and others spiral, so that the bran is more effectually taken up. An ordinary form of elevator is employed to take up the bran as it discharges through a spout and return it to the top of the casing, and thus ensure a continual change of the coating on the barrels.

[*Printed*, 6*d*. *Drawing.*]

A.D. 1877, May 15.—No. 1901.

GUTENSOHN, Adolf.—(*Provisional protection only.*)—Separating tin from tinned plate etc.

The tinned plate or scraps are covered with muriatic acid in a vessel preferably of earthenware. When the tin has been

sufficiently dissolved, the acid is drawn off and used for fresh supplies of plate or scraps until it has dissolved as much tin as possible. From this solution crystals of muriate of tin may be obtained by evaporation as usual. There is then placed in a vessel a little copper ore or salt of copper (such as sulphate), preferably from 1 to 2 per cent. of the weight of plate or scraps, of which a fresh supply is added until the vessel is full enough, and there is then added the acid saturated with tin as above described, having first added to it about 2 per cent. in weight of liquid ammonia. By treating the saturated acid with copper and ammonia as described, it can be used many times for dissolving fresh quantities of tin, copper ore or salt and ammonia being added as often as required. Thus a much stronger solution of muriate of tin than usual is obtained. From this solution crystals of metallic copper gradually precipitate, and on exposure to the air yield (green) copperas. Liquid ammonia is added to the remaining solution of muriate of tin to precipitate oxide of tin, but the solution is preferably first neutralized by ammoniacal liquor. To obtain the precipitated oxide of tin nearly free from iron, there is added to the neutralized solution about 1 to 3 per cent. by weight of a saturated solution of a permanganate (as of potash or soda), which combines with the iron, and in this way the oxide of tin retains not more than 1 per cent. of iron. The precipitated oxide of tin may be dissolved in diluted sulphuric acid, and then, by adding metallic zinc, spongy metallic tin may be precipitated for melting into ingots.

[*Printed*, 2*d*. *No Drawings.*]

A.D. 1877, May 18.—No. 1958.

MOLLOY, Bernard Charles, and WARREN, John Davis.—Recovering nitric acid in connection with metallurgical processes.

The fumes of the lower oxides of nitrogen, arising from the decomposition of nitric acid in oxidizing processes, may be led into gas-tight towers, which are preferably 30 feet high and 3 feet in diameter and constructed of glazed earthenware pipes (or slate or other acid-resisting material), and are built up and jointed with plaster of Paris. To the upper part of the tower are fitted one or more jets through which steam and water,

preferably at about 100° Cent., are forced, and so brought into contact and adjusted that a cloud or spray of finely-divided water of the temperature mentioned may fall slowly through the tower, which rests in a tank having a water joint. Air or oxygen simultaneously enters the tower under control. By the continued action of the oxygen and aqueous spray, the lower oxides are gradually oxidized and re-converted into nitric acid, which collects in the said tank. Two towers may be united by a pipe in connection with a water joint (or equivalent), so that an excess of the fumes in the first tower would at a given pressure pass into the second. Again an escape chamber or slightly-inclined chimney, with alternate baffle-plates or projections so that vapour and gases will slowly take a zig-zag course in it, may be used to effect absorption and condensation and so prevent loss. Glazed or equivalent openings or bottomless stoppered bottles may be provided in the sides of the tower to indicate by the depth of colour shown the quantity of fumes present.

By turning a tap at the foot of the tower nitric acid may be added to ground and roasted auriferous iron pyrites, contained in a closed tank and kept hot therein by a steam jacket or otherwise. Sufficient hydrochloric acid is also added for acting on "the metal." The remaining oxidizable matter in the ore is oxidized, and the hydrochloric acid splits up and gives nascent chlorine to combine with the gold and silver, if present. At the end of the operation steam is injected to blow off any of the lower oxides remaining in the solution, and the fumes can only escape into the tower. The solution is discharged through a sluice door into a settling-tank and subsequently is drawn off by taps into a precipitating-tank, while the residue is washed and the washings are likewise passed into the precipitating-tank, which is also closed and connected to the tower, some nitric acid being present in the solution. A reducing-agent, like ferrous salt or sulphurous acid, is added to precipitate the gold, but the ferrous salt first decomposes any nitric acid by becoming oxidized into ferric salt, the fumes passing into the tower. The ferrous salt (assisted by a jet of steam) then precipitates all the gold, which is collected and fused. Any copper present will remain in the solution, which may be run over scrap iron as usual. Silver will be found as an insoluble chloride in the magma in the settling-tank, and

is dissolved out by a hot solution of salt, from which the silver is precipitated by a bar of zinc in another precipitating-tank.

[*Printed*, 4*d*. *No Drawings*.]

A.D. 1877, May 25.—No. 2047.

SCOTT, James Cuthbert.—(*Provisional protection only*.)—Furnaces.

A chamber, into which the molten metal flows, and from which it is tapped as required, may be constructed beneath the ordinary bed of a cupola furnace. The bottom of the cupola is formed "as an arch, beyond which it is continued downward "so as to constitute a chamber," a pillar supporting the crown of the arch, which has perforations for the molten metal to run through into the chamber.

[*Printed*, 2*d*. *No Drawings*.]

A.D. 1877, May 26.—No. 2051.

BOWER, George.—Protection of metallic surfaces from atmospheric and other influences.

A protective film or coating might be formed upon the surfaces of articles made of copper or alloys, such as brass, by the oxidizing action of air or oxygen, or both, at an elevated temperature. From a dull to a bright red heat is the temperature preferred. The retort, chamber, or other apparatus, in which the action takes place, may be externally heated, or a heated current of the oxidizing-agent may be used.

[*Printed*, 4*d*. *No Drawings*.]

A.D. 1877, May 28.—No. 2070.

WILLIAMS, Thomas.—Annealing.

Annealing-boxes are made with an outer casing and cover, the space between being filled up with sand in order to ensure more uniform temperature. The furnace is divided into compartments by partitions and has cast-iron floors made with grooves, corresponding grooves being arranged in the bottom of the annealing-boxes. Spherical rollers are placed in the grooves of the floor plates and boxes, so that the latter may be placed in and withdrawn from the furnace freely.

[*Printed*, 6*d*. *Drawing*.]

A.D. 1877, June 1.—No. 2137.

CLARK, ALEXANDER MELVILLE.—(*A communication from La Société Anonyme des Mines du Rhin.*)—Metallurgical furnaces.

For calcining or reducing (and even distilling), there may be used a furnace, "in which a current of well determined chemical "character is substituted for the direct action of the flames as "in reverberatory furnaces, and in which the greater part of "the hand labor is replaced by machine power." The furnace resembles a cylinder or truncated cone set on its base, and comprises a grate, air chambers, blower, and air inlet and heating pipes, with a hearth. The furnace is closed and the flames do not traverse it, the matters for treatment being spread in a thin layer on the hearth and receiving heat by transmission. A rotating hollow shaft, supported in a central footstep bearing and projecting through a stuffing-box in the furnace roof, carries radiating perforated pipes, by which a forced current from a gas holder or the atmosphere is directed upon the surface of the matters for treatment, while rakes, also attached to the shaft, have teeth so arranged as to travel in different circular paths, "whereby an intimate working and mixing of the melted "matters" are effected. The said current on its way to the shaft is passed through coiled or serpentine pipes, which are exposed to the flames. The current acts chemically according to its composition, air, carburetted hydrogen, and steam having different effects. The current leaving the furnace may convey vapours or gases to a condenser. The charge is introduced through a hopper in the roof, and a scraper, when lowered, collects the matters and discharges them at a doorway.

The construction of the furnace may be simplified by replacing the injection pipes by tuyères traversing the sides. The hearth may be modified when the substance treated is liquid or easily fusible.

In treating an ore, containing blende, argentiferous galena, and cupreous pyrites, the ore in the state of "slick" is spread in a thin layer on the heated hearth by means of the rakes, and, the temperature and introduction of heated air being regulated, the metals are sulphatized. Chloride of sodium is then added in proportion to the sulphates to be transformed. The air current, which is checked during chlorination, should be afterwards gradually introduced and the temperature raised to volatilize the chlorides, the copper, zinc, silver, and part of the

lead and iron being thus carried off. Superheated steam may replace the air. The fixed residue, containing sulphates of lead and soda, is immersed in a liquid to separate soluble matters, and then dried and treated by ordinary metallurgical processes. The metals are extracted by known means from the liquids charged with chlorides in the condenser.

Sometimes two furnaces are employed together. The ore is first sulphatized in the upper furnace, and thence passed to the other, where the operation is completed, each furnace having its special temperature.

[*Printed*, 8*d*. *Drawings*.]

A.D. 1877, June 7.—No. 2220.

FOLEY, James.—(*Provisional protection only.*)—Furnaces for melting metals, including brass.

A base-plate is provided with a flange, removable in sections, and carries a ring or flange, having feet or supports to raise it slightly above the base-plate. Upon the ring is built a preferably-vertical cylindrical furnace, having an outside cylindrical casing, which rests on the base-plate and forms an air chamber round the furnace. Into this chamber, which is covered, a pipe supplies a blast of air. The latter in descending becomes heated by contact with the brickwork of the furnace, passes under the said ring, and enters the bottom of the furnace, which the waste gases leave by an outlet at the top. The furnace "requires no "fire-bars; the fuel is first fed in at the top, the pot or crucible "containing the metal is then inserted, after which more fuel "is added." Sections of the flange of the base-plate may be removed to give air (when the blast is not in use), ignite the fuel, or remove spilt metal.

[*Printed*, 2*d*. *No Drawings*.]

A.D. 1877, June 9.—No. 2243.

HEATHFIELD, Richard.—Galvanizing sheet iron.

The bath of melted metal is provided with one or two additional pairs of rolls, the axes of which are contained in planes at right angles to the plane containing the axes of the ordinary rolls. The plate is received by a guide, passes through the ordinary rolls, is turned upwards by a second guide, and

removed by the supplementary rolls. The ordinary rolls are adjustable by screws, while the supplementary rolls are adjusted by a cam attached to a vertical spindle, which is held in position by a pawl.

[*Printed*, 6*d*. *Drawings*.]

A.D. 1877, June 12.—No. 2283.

STORER, Jacob Jones.—(*Letters Patent void for want of final Specification.*) — Furnaces for heating, melting, roasting, or otherwise treating ores, metals, etc.

Particularly to adapt such furnaces for the combustion of pulverized fuel, they are constructed with "continuously curved "internal surfaces at the roof and sides," except at the working doors; also with small fireboxes or gas generators for the primary heating of the furnace and the ignition of the pulverized fuel; also with a low and broad opening over "the flue "bridge," and an opening in the rear wall for injecting the fuel. The roof of the furnace over the flue bridge has a metal box or bosh, to be supplied with water to prevent rapid burning at that point. Also "water boshes" are provided to prevent excessive consumption of the fettling or lining. Hot-blast pipes may supply heated air in connection with the pulverized fuel. Existing furnaces may be adapted.

The invention is not applicable to blast and other vertical furnaces.

[*Printed*, 2*d*. *No Drawings*.]

A.D. 1877, June 27.—No. 2480.

HEATHFIELD, Richard.—Galvanizing sheet iron.

The molten surface is equally divided by a bar which is parallel to the longer sides of the pot. The plate is introduced at one side of the bar, the long edges of the plate being horizontal. The plate is then conducted to guides and delivery rollers, which discharge it on the other side of the dividing-bar.

[*Printed*, 6*d*. *Drawing*.]

A.D. 1877, June 28.—No. 2499.

BUTLER, Arthur Alexander Ladislaus.—Annealing-pots.

To distribute the metal so that the pot is thickest and

strongest at the top, where most exposed to heat, and tapers from the top downwards, the inventor employs a cast-iron mould, which is formed of two or three symmetrical parts, joining each other in a vertical plane. One part is fixed to the base-plate of the mould, and the others are movable, but capable of being secured to the fixed part (as by hinged staples and buttons) during the casting process. A sand core is placed concentrically in the axis of the mould, and the pot is cast in an inverted position by pouring molten cast-iron into the space between the core and the mould and above the core. Air and vapour may escape from the core through a central perforated tube and hole in the base-plate. On subsequently removing the movable parts of the mould, the pot may be lifted off the core.

[*Printed*, 6*d*. *Drawings*.]

A.D. 1877, June 29.—No. 2509.

BRABY, Frederick, and MOORE, Arthur Charles.—Galvanizing.

One or two slowly-rotated and partially-immersed rolls keep the chloride of ammonia or other covering-material from a narrow strip of molten surface through which the plate or other article is delivered ; or one roll only may be used, the other being replaced by a fixed strip. The covering-material may be aluminium or fresh or spent chloride of ammonium, or these may be replaced by the gaseous products of combustion from the heating-furnace, and the flux, which may also contain sand, may be further economized by confining it to a narrow strip behind each roller by means of a partially-immersed plate.

The fumes may be collected and removed by a hood, through doors in which the flux may be introduced and when exhausted removed. Separate hoods may be used covering the receiving side and the delivery side, the two parts being separated. The plates or other articles are introduced through a trap door to prevent escape of fume, and are dried and warmed before, and kept warm after, immersion by the hot gaseous products of combustion. The plates are conducted beneath the bath by fixed or roller guides, and one or two simple flap or other safety valves may be used to prevent excessive pressure.

[*Printed*, 6*d*. *Drawing*.]

A.D. 1877, July 4.—No. 2568.

DALTON, George.—Breaking stones etc.

With a machine for breaking between a movable and a stationary jaw, the inventor so combines an engine for operating the movable jaw as to admit of the engine gear being disconnected from the actuating-lever of the jaw, so that the engine may drive other machinery or be used for winding purposes. The combined engine and machine may be made self-propelling on wheels.

A crane may constitute part of the machine, for lifting portions thereof (as the jaws or their movable faces) for facility of renewal. The post of the crane may be fitted in a recess in the framing of the machine. A worm and worm-wheel worked by one man may actuate the crane.

A mode of constructing pin joints for stone-breaking and other machines admits of the working parts being tightened when worn. Of two rods to be connected, say the rocking lever and connecting-rod of a stone-breaker, one rod is bifurcated and embraces the other at its boss or extremity, which is enclosed between the two branches of the fork, and the whole is connected together by a pin having feathers, parts of which engage in grooves in the enclosed boss of the secondly-mentioned rod and other parts in grooves in conical brasses fitted in corresponding holes in the two branches of the bifurcated rod. One extremity of the pin has a head, and on the other (which is threaded) there are fitted one or more nuts, by tightening which the conical brasses are set up equally on opposite sides to compensate for wear in the surfaces of the joints.

[*Printed*, 6*d*. *Drawings*.]

A.D. 1877, July 7.—No. 2619.

BOLTON, Francis John.—Treatment and separation of ores etc.

Particularly for separating iron and copper pyrites from blende etc., mixed ores containing pyrites may be calcined in an atmosphere of dry superheated steam, air or gases being partly or wholly excluded. Thus the iron of the sulphides is converted into magnetic oxide, while the formation of soluble sulphates of copper and zinc is avoided, the magnetic particles being afterwards separated by a magnetic separator.

In using a magnetic separator, if the material treated be finely divided, the force of gravity may not suffice to cause the non-magnetic particles to disengage themselves from the magnets. The inventor therefore applies steam, air, or water to remove the non-magnetic particles, but not so violently as to overcome the adhesion of the magnetic particles. Or a shaking or jigging motion might be imparted to the separator. A grooved form of electromagnet might be used to increase the attracting surfaces, and the magnetic particles might be disengaged by means of a reversed current of electricity.

[*Printed 4d. No Drawings.*]

A.D. 1877, July 7.—No. 2623.

BOURNE, JOHN.—Melting metals.

A crucible may contain a perforated horizontal division plate, so that the metal as it melts may flow drop by drop through the perforations into the bottom of the crucible. A cover is luted on the crucible, and a vacuum is maintained in the latter by a pipe leading from the cover or other part of the crucible to an exhausting-machine. Thus, each successive thin layer of metal as it melts is exposed to the action of a vacuum, whereby the gases in it are sucked away, and the metal is improved for casting. This result may be likewise obtained by running the molten metal in a state of fine division into a tall exhausted cylinder.

[*Printed, 4d. No Drawings.*]

A.D. 1877, July 16.—No. 2732.

BELLUOMINI, FRANCISCO.—(*Provisional protection only.*)—Tin plate.

The iron plates, upon being removed from the water in which they are placed after being cleansed from oxide in the usual way, are immersed in melted colophony, instead of in oil or grease, to protect them from oxidation and prepare them to receive the tin coating. The hermetically-closed annealing-boxes, instead of being made of iron, are constructed of refractory clay.

[*Printed, 2d. No Drawings.*]

A.D. 1877, July 19.—No. 2754.

HADDAN, Frank William.—(*A communication from Asahel Knowlton Eaton.*)—(*Provisional protection only.*)—Separating silver and other precious metals from lead.

A preferably-parabolic cast-iron bowl or bath is heated by a furnace, mounted upon a vertical shaft, rotated or driven by convenient means, and surrounded by an annular trough to receive the lead when discharged by centrifugal force. "The "process consists in thus centrifugally driving off or separating "the lead, and for this purpose, or as assistant thereto, to the "alloying the silver-bearing lead or metal with (say) from one "to two per cent. of zinc" or some equivalent. The motion given to the combined mass of heated metal in the bowl tends to cause the lead to separate and overflow into the trough, "the "persistent and lighter alloy not responding so readily to the "centrifugal action, but remaining in a concentrated condition "in the bowl." If gold be also present, the metal should cool down and form a crust before starting the centrifugal action.

[*Printed*, 2*d*. *No Drawings.*]

A.D. 1877, July 19.—No. 2759.

HOLLWAY, John.—(*Provisional protection only.*)—Utilizing metalliferous substances.

Scoriæ, residues, ores, and substances, containing, for instance, iron and small percentages of more valuable metals, may be treated. Burnt cupreous pyrites, not containing much silica, may be smelted, preferably with silicious refuse from copper ore washings and fluxes. Thus, while providing silica to form slag, the percentage of copper would be increased in the product by any copper reduced from the silicious refuse. The product would be an alloy of iron and copper. The metalliferous substances may be smelted in a blast furnace with fluxes, and other substances if desired, ferreous alloys being thus obtained. Sometimes metals, such as lead, would be reduced separately from these alloys, and in other cases metals could be collected as sublimates, such as oxides of zinc, lead, and arsenic. The inventor preferably pulverizes and mixes the substances with the fluxes and carbon, and forms cement or cokes them into blocks for smelting. Thus the disintegration of the substances partially allows of separation and treatment of the heavier

metals by themselves and removal of impurities by washing or otherwise, reduction and fusion being facilitated, and less metal being lost in the slag. Also the substances can be so mixed that specific alloys can be produced containing desired proportions of various metals and for particular purposes.

These alloys can be used for the deposition of copper and other metals from natural or artificial solutions. The iron in the alloys is thus utilized for precipitation, while obtaining the copper and other valuable metals from the alloys, together with the copper and other metals from the solutions, iron replacing the metals in solution. When such solutions are not available, the iron could be dissolved out of the alloys by a solution of perchloride of iron, and the alloyed metals thus liberated.

[*Printed*, 2*d*. *No Drawings.*]

A.D. 1877, July 23.—No. 2807.

LYTE, Farnham Maxwell.—Treating ores containing silver, copper, or lead.

The inventor's prior Specification No. 633, A.D. 1877, is referred to.

The pulverized and, if needful, calcined ore is treated with sulphuric acid in an oven or hot chamber until all the silver and other metals to be extracted have been converted into sulphates. Acid sulphates, such as of soda or potash, may replace sulphuric acid. The material under treatment generally cakes and may be crushed. If the minerals have not been completely attacked, the crushed material may be treated with muriatic acid in a vat to completely chloridize the metallic bases and leave an excess of acid. Ordinarily the sulphatized material may be treated directly with hot brine acidulated with muriatic acid, this being a powerful solvent for even the sulphate of lead. For freshly-precipitated lead salts a neutral solution may suffice. To separate copper from lead, the ore is treated with a solution of sulphuric acid, with a little chloride of sodium if silver be present. The acid present should be in such proportion as to dissolve the copper but not the lead, *i.e.* there should be a large excess of sulphuric acid as compared with any brine present, or an alkaline sulphate in sufficient proportion may be added to the acid solution. The copper is more completely dissolved by exposing the solution to the air, when all the copper becomes

converted into sulphate. The copper is recovered as usual. The residual material is treated with brine acidulated with a little sulphuric or preferably muriatic acid, to dissolve out the lead and silver, which may be recovered by means of zinc in accordance with the prior Specification. Other (acidulated) alkaline and metallic chlorides may replace brine. Tubs heated by steam are preferred for the treatment. If the ore contains silver but no lead, some lead salt may be added before using the brine, so that the silver and lead may be afterwards precipitated together by zinc. Much sulphuric acid may accumulate in the chloride of zinc and sodium solution remaining, and, as calcium sulphate, interferes with the recovery of the zinc by distillation from the zinc oxide obtained by precipitation with lime. The sulphuric acid should therefore be first precipitated as calcium sulphate, by adding some calcium chloride residue of a former operation. The treatment with acidulated brine may be applied to lead sulphate and lead chloride residues from dye works, lead ashes, etc. Gold present in an ore will be found in the gangue or matrix remaining after the above treatment, and may be extracted by known processes.

[*Printed*, 4*d*. *No Drawings.*]

A.D. 1877, July 26.—No. 2848.

WOOD, JOHN.—(*Provisional protection only.*)—Manufacture of crucibles and other articles from plastic materials.

To prevent the moulded article from adhering to the mould, one or more stationary knife blades or detachers may be used in connection with and extending into a revolving mould. The blade, which lies as close as practicable to the mould, acts as a separator and prevents the plastic material from adhering, so that the moulded article can be readily withdrawn from the mould. Water or lubricant may be admitted between the article and the mould. The blade may be used in connection with moulds which impart interior forms to the articles. A revolving blade may be employed with a stationary mould.

[*Printed*, 2*d*. *No Drawings.*]

A.D. 1877, July 31.—No. 2922.

UNDERWOOD, GEORGE.—Treating ores.

The following "method of compression, concentration, and

" admixture may be applied to other kind of metallic ores " than those of iron. Iron ores, after being reduced to " sizes " suitable for classifying, and passing through trommels or " other apparatus preparatory to washing same in machines so " arranged that by specific gravity the mineral is separated " from the free silica and other earthy impurities," are mixed with manganese, lime, or other cementing or fluxing ingredient, either in powder or mixed with liquid. The mixture, or the ore by itself, is compressed in moulds to form blocks, easily portable and better for smelting purposes.

[*Printed*, 2*d*. *No Drawings*.]

A.D. 1877, August 4.—No. 2984.

MASON, JAMES.—Obtaining copper.

Cupreous pyrites, in its natural state or broken or subdivided, is subjected in heaps, mounds, or piles to the combined or alternate action of air and water, in order to render soluble and dissolve certain compounds of copper. The resulting solution may be submitted to a cementation or other process to separate the copper therefrom. The air preferably passes upwards and laterally through the heaps of pyrites, and the water downwards. The pyrites may be afterwards used for making sulphuric acid.

[*Printed*, 4*d*. *No Drawings*.]

A.D. 1877, August 6.—No. 2993.

MASON, JAMES.—Blast furnace charges.

Rendering " directly available for the production of iron or " steel " in a blast or any other furnace, certain residues resulting from the burning of cupreous iron pyrites (either crude or previously treated in accordance with the preceding invention) in the manufacture of sulphuric acid. These residues may (without previous pulverization or disintegration) be subjected to the action of a solvent, such as water or water acidulated by hydrochloric or sulphuric acid, to extract the compounds of copper which have been rendered soluble by burning, and may be afterwards calcined to expel the residual sulphur, leaving the residues " in their individual condition " for use.

[*Printed*, 2*d*. *No Drawings*.]

A.D. 1877, August 7.—No. 2996.

KAGENBUSCH, John Peter, and KERR, Robert Henry.—(*Provisional protection only.*)—Extracting or separating metals, especially gold, silver, and platinum, found in minerals and slags at alum, iron, lead, copper, zinc, and tin mines and works, from silicates, aluminates, sulphur, and other impurities.

The inventors roast the mineral "with one quarter of its "weight of coal, throw it red hot into cold water twice, then "use the ordinary fluxes" suitable for the mineral, with one ounce of sulphate of copper and of zinc, respectively, per pound of mineral, in order to create electricity, with additional flux, say, carbonate of soda, to liquefy the mass. "Metal will then be produced in either crucibles or furnaces, "which contains the precious metals" and can be refined in the ordinary way.

[*Printed*, 2*d*. *No Drawings.*]

A.D. 1877, August 9.—No. 3043.

VON DOUSSA, Alfred.—(*Provisional protection only.*)—Separating or washing out diamonds.

The diamondiferous soil, as soon as it is raised from the mine, is fed into a receptacle and there crushed, water flowing during the process. The crushed soil, of a muddy consistency, is forced out of the receptacle, through a grating on its front, by the entrance of fresh soil. It falls upon a moving inclined grooved table, where the diamonds separate from the soil and collect in the grooves, while the refuse is carried away through sluices. Diamonds too large to pass through the grating collect on the bevelled edge of the false bottom of the receptacle. This has a movable false bottom provided with an N-shaped metal block, presenting an edged surface to the crusher, and so allowing the diamonds to fall between its branches and thus escape crushing. The side of the false bottom next the above-mentioned grating is bevelled.

The crusher works within the receptacle, and has a vertical and rotary motion derived from a cam, connected with it by a rod and operated by a lever worked by a steam engine or other motor.

The inclined grooved table is given a shaking movement by a steam engine or other motor.

[*Printed*, 2*d*. *No Drawings.*]

A.D. 1877, August 22.—No. 3192.

GEDGE, WILLIAM EDWARD.—*(A communication from Louis Nicolas de Meckenheim.)*—Furnaces.

Different arrangements of melting and puddling furnaces may be employed in combination. The superabundant gases of a blast or cupola furnace may be used to heat one or several puddling-furnaces, which, however, may have supplementary fireplaces. The gases may leave the cupola through numerous small fireclay tubes, in order that the flames may become quickly extinguished in passing therethrough, and thence the gases are led through pipes to the puddling-furnace to be re-ignited. Or the latter may be heated by the direct flame of a melting-furnace, a kind of rectangular melting-cupola with tuyères at each end in one case being built beneath the roof of a puddling-furnace according to a drawing. The metal may run from the melting to the puddling furnace through an iron trough lined with clay and lime, or may be transferred by means of a vessel movable on rails and a lift. A reverberatory furnace may contain a melting-chamber between the fireplace and a puddling-chamber, and a little above the level of the latter. A puddling-furnace may have two working doors on one side, thus "preventing current of cold air." Hot blast may be used, or, with a fireplace having bars, a current of air may be drawn in by the chimney. A gas generator is sometimes employed. Different kinds of fuel may be used, including coke and raw fuel, charcoal, and dry wood. Air may be made to circulate beneath the puddling-chamber by the aid of draught tubes with regulators. The claims extend to the use (in constructing the apparatus employed) "in the form of bricks, or of "beton or concrete. of magnesian products previously calcined "and pulverised, with addition of boracic acid or of a mixture "of alum, chloride of lime, and chlorhydric acid."

[*Printed*, 10*d*. *Drawings*.]

A.D. 1877, August 23.—No. 3203.

MASON, JAMES.—Treatment of the residue of the roasting of iron pyrites containing copper.

The inventor refers to his prior Specification No. 2984, A.D. 1877, which relates to separating certain compounds of copper from cupreous iron pyrites by the action of air and water.

Rendering certain residue resulting from the burning of cupreous iron pyrites (either crude or previously treated in accordance with the prior invention) in the manufacture of sulphuric acid " directly available for the production of iron or " steel" in a blast or any other furnace. This residue may (without previous pulverization or disintegration) be subjected to the action of a solvent such as water or water acidulated by hydrochloric or sulphuric acid, to extract the compounds of copper which have been rendered soluble by burning. The residues are afterwards calcined, preferably at a low temperature, alone or in conjunction with salt, to render soluble the residual compounds of copper, which are thereupon extracted, and the residues are then further calcined to expel the residual sulphur, leaving " the residue in its undivided condition " for use.

[*Printed*, 4*d*. *No Drawings.*]

A.D. 1877, September 5.—No. 3370.

SIEMENS, Charles William.—Furnaces.

In a regenerative gas melting-furnace, the two pairs of regenerative chambers may be placed behind the bed and communicate with the melting-chamber by separate throats to convey the heated air and gas. According to drawings, all the throats open into the melting-chamber on one side, the throats for air being above those for gas, while on the opposite side of the chamber there are three doors and tapping-holes.

[*Printed*, 6*d*. *Drawing.*]

A.D. 1877, September 10.—No 3420.

JENSEN, Peter. — (*A communication from August Ernst Müller.*) — (*Provisional protection only.*) — Alloys for chronometer mechanism.

An anti-friction metal, used for the wheels, consists of metals mixed in or about the following proportions :—45 per cent. of silver, 30 of copper, 9 of tin, 9 of zinc, and ·7 of lead. This silver alloy is as hard as forged steel, and is still malleable and will take a good polish.

For the cylinder pendulum springs, there may be used an " alloy of platina with iridium melted, 80–90% of platina " with 20–10% of iridium. According to the degree of

"hardness more or less iridium is used." The alloy can be hammered, and that which is more soft can be cast. It does not rust, and takes a fine polish. Its lineal expansion is the slightest, and its modulus of elasticity is the least variable among metals.

[*Printed*, 8*d*. *Drawings*.]

A.D. 1877, September 15.—No. 3486.

NEWALL, ROBERT STIRLING.—Furnaces for calcining etc.

The bottom of the calcining-chamber is a circular disc, either flat, conical, or arched upwards. It may be formed of iron plates, tied by an angle-iron ring or rim, which is level with a lining of firebrick, covering the iron bottom, and whereon calcination takes place. A circular rail, fixed to the bottom, is bevelled to rest properly on supporting wheels fixed to the floor. A centre pin, around which the bottom is made to revolve by toothed wheels or otherwise (including by friction, one of the supporting wheels being driven), guides the rail on the supporting wheels. Thus the bottom moves concentrically and with little clearance within an outer ring, which supports a firebrick or other arch covering the bottom, so that the flame from the fireplace will play on the material to be calcined. The material is fed in through openings in the arch, and ploughs arranged round the outer ring prevent it from passing over the edge of the bottom. The material may be kept stirred or mixed. Stirring-ploughs can be inserted through an opening in the arch and be supported on a frame, which rests on the outer ring and on a girder, thrown across the arch. These ploughs are set to stir the material alternately towards and from the centre, and they push it out, when sufficiently calcined, and it is drawn out at an opening in the outer ring. A central pillar divides the flame coming from the fireplace, and protects the stirring-ploughs, the products of combustion being led off by flues shown in a drawing as placed at some distance on each side of the line of stirring-ploughs, which are at the opposite side of the calcining-chamber to the fireplace.

Fuel may be supplied to the fireplace by using a circular grate with a central opening, wherein is fixed a short cylinder, through which the fuel is pushed on to the grate. Beneath this are two bars, whereon slides another short cylinder having a

tail piece, which closes the bottom of the upper cylinder while the lower one is pulled forward to be filled with fuel. When this cylinder is replaced, the fuel is pushed through the upper cylinder by a piston. Again, a gas furnace may be used.

[*Printed*, 6*d*. *Drawing*.]

A.D. 1877, September 17.—No. 3496.

HUTCHINGS, RICHARD JAMES, and JOHN, THOMAS.—(*Provisional protection only*.)—Cleaning tin, terne, and other metal plates.

The plates are passed through rubber-coated rollers into bran, crushed lime, etc. contained in boxes of wood or iron capable of receiving a reciprocating motion. The rollers may also reciprocate, and guides are used to direct the plates, which are finished by polishing-rollers.

[*Printed* 2*d*. *No Drawings*.]

A.D. 1877, September 20.—No. 3537.

JOHNSON, JOHN HENRY.—(*A communication from Emile Malétra*.)—(*Provisional protection only*.)—Metallurgical furnaces.

In the case of furnaces having a rotating sole or hearth, by removing the " portable furnace " described, access can be readily obtained to the hearth or cylinder for repairs: also, by withdrawing the furnace, the distance between itself and the cylinder can be regulated under the expansion from heat, so as to check the passage of cold air between the two, while preventing contact of their surfaces. The said " furnace " is mounted on a carriage formed of girders, connected together and provided with four travelling wheels at their ends, while a fifth wheel is supported centrally a little above the ground, and serves as a pivot for changing the direction in which the furnace is travelling, by raising it on blocks or wedges. The furnace comprises two or more fireplaces, separated by a low wall on the central girder, and provided at different elevations with firebars. An inclined arch extends from front to back, where the external wall, forming a bridge, is provided with a cylindrical opening for the passage of the gases of combustion.

[*Printed*, 2*d*. *No Drawings*.]

A.D. 1877, October 12.—No. 3782.

EDWARDS, Jonathan.—(*Provisional protection only.*)—Doors of heating, puddling, and other furnaces.

To fasten the sliding doors of furnaces without using wedges, "a lever fastening, consisting of three sides of a rectangular "frame," is jointed to the front of the door frame. The free ends of the two shorter sides of the fastenings "carry pivots or "centres, which turn in open bearings made in brackets at the "front of the door frame," while the other ends are connected together by the longer side of the fastening, which constitutes a handle for moving it. The said free ends are formed into cam-like ends, eccentric to the pivots. When the fastening is brought into a horizontal position, the cam-like ends bear against the door and hold it firmly against its frame. The door is released by raising the fastening into a nearly-vertical position, in which it is held by a lever catch on one side of the door frame.

The front of the stopper for closing the rabble-hole in a puddling-furnace door may be made "of a plate having at its "back a small chamber," which fits closely in the said hole and is filled with fireclay. The stopper may slide and swivel on a peg above the hole and can rest (clear of the hole) on a support on the door. "The outer edges of the metal block fixed around "the inside" of the hole may have inclined edges, against which fit the correspondingly-inclined edges of fireclay lining bricks.

[*Printed*, 2*d*. *No Drawings.*]

A.D. 1877, October 19.—No. 3868

HADFIELD, Robert.—Decarburizing or annealing and softening portions of steel, iron, or other metal articles.

The articles, which include rolls for rolling-mills, are first made or cast "throughout of as hard a temper as it is desired; "the hardest portions thereof should ultimately remain." Afterwards such parts of the article as are to retain their primary hardness are subjected to a blast of very cold air, or preferably are immersed in a current of cold water, while the other parts, which require to be softened, are exposed to the requisite heat for annealing or reducing the carbon

present in any desired ratio, the process admitting of the softness being graduated.

[*Printed*, 4*d*. *No Drawings*.]

A.D. 1877, October 24.—No. 3923.

PHILLIPS, ARTHUR GAVED.—(*Letters Patent void for want of final Specification*.)—Extracting silver from copper precipitate.

Copper precipitate, produced in the wet extraction of copper from cupreous ores, and like copper products may be thoroughly mixed with common salt and an alkaline carbonate or other alkali, adding sufficient water to make a mortar-like paste, which, after being dried and any lumps broken down, is roasted in a reverberatory or muffle furnace with constant stirring until all the copper has been converted into oxide and the silver into chloride. The latter is extracted from the roasted mixture by lixiviation with a solvent, such as hot brine. The alkali added decomposes any volatile salts of copper, and checks volatilization of silver during the roasting.

[*Printed*, 2*d*. *No Drawings*.]

A.D. 1877, November 1.—No. 4053.

CONRADI, HENRY.—(*A communication from Emil André*.)—Electro-metallurgy.

The invention extends to obtaining metals otherwise than by electrodeposition.

Impure metals, coins, alloys, "combinations with sulphur, "arsen., chlor., etc.," coarse metals, intermediate products, ores, rubbish, and scrap by electrolytic action may be purified and transformed into pure metals, alloys, combinations, salts, or haloids, the products being either transported to the cathode or left at the anode or in the bath. Magneto-electric or electro-dynamic machines are employed with constant baths and anodes free from polarization. The anodes may be made of the material for treatment, if it conducts electricity, while non-conducting materials are dissolved in acids, alkalies, or salts, and then the anodes may be made of conducting-substances, such as plastic coal or platinum, or of metals which will dissolve (the secondary products of the anode being separated from the principal solution by diaphragms). The cathode is

formed of coal, or of metal similar to that which is precipitated, or of metal which is to be alloyed with the same. When three or more metals are to be disunited in one operation, an intermediate metal or other substance is applied, by which one of the dissolved metals is precipitated before reaching the cathode, whereon only the second dissolved metal is precipitated, the third metal being left at the anode. Thus, in refining to separate gold, silver, and copper from each other or from other admixtures, these alloys forming the anodes are put into a bath of sulphuric acid and water. Between the anodes and cathodes the bath is divided into two parts by a frame, which is filled up with granulated copper or scrap between the cotton stuff or permeable diaphragm covering the frame. Silver and copper become dissolved, while gold and other substances are left at the anode. Silver is precipitated at the frame by the granulated copper, and copper alone is precipitated at the cathode. The precipitated silver is washed, cleaned, and burnt in the refinery or melted directly. In a modified arrangement the solution of silver and copper is drawn off continuously into an adjoining vat, containing granulated copper, where the silver is precipitated; and then the solution passes into a third vat, standing somewhat deeper, at the cathode, where the copper is precipitated, the acid solution being afterwards conducted to the anode. Again, a combination of nickel and copper with other metals may be treated in an acid bath, if copper alone is to be precipitated. Nickel is at the same time dissolved and the bath will contain nickel sulphate, a little acid, and a little iron. The nickel sulphate is purified by ammonia, the iron being deposited as hydrate of peroxide, which is removed by filtration or decantation, and the solution is evaporated until the nickel sulphate crystallizes. Copper and nickel may be precipitated together, using a bath of ammonia sulphate and caustic ammonia. They are brushed off the cathodes, washed, cleaned, and melted and worked like an alloy. Combinations containing cobalt and copper may be treated. A solution of silicate nickel ores in sulphuric or muriatic acid may be used for obtaining nickel. Other metals obtainable by this invention include tin and zinc. Conical or rotating anodes or cathodes may be sometimes used.

[*Printed*, 4*d*. *No Drawings.*]

A.D. 1877, November 2.—No. 4074.

HADDAN, Herbert John.—(*A communication from Alexis Drouin and Joseph de Baxeres de Torres.*)—(*Provisional protection only.*)—Treating ores containing silver and copper.

The ore, after pulverization, is treated with a hot or cold acidulated solution of marine salt, in order to obtain the chlorides of silver and copper and recover these metals. Nitric acid may be used to acidulate the solution. Binoxide of manganese may be employed to facilitate the dissolution of the chloride of silver. The treatment may take place (with stirring) in casks with double sides and bottoms covered with cloth, which serves as a filter.

[*Printed*, 2*d*. *No Drawings*.]

A.D. 1877, November 6.—No. 4135.

DALTON, George.—Breaking stones etc.

The inventor refers to his prior Specification No. 2568, A.D. 1877.

1. In machines, wherein the lever or rod for operating the movable jaw through the intervention of the toggles is worked by an eccentric, the inventor employs a "triplex eccentric," having three parts, and divides the connecting-rod into three parts, respectively acted upon by those of the eccentric. Two parts of the eccentric and of the rod respectively work in unison and form practically one eccentric and rod, while the other part of the rod is acted on by the other eccentric, the former parts of the rod being raised when the latter part is depressed and *vice versâ* ; but the different parts act simultaneously by means of their respective toggles upon the undivided movable jaw. Thus an "equilibriating action" is obtained, and the liability to fracture of the eccentric shaft is obviated.

2. For varying the throw of the toggles to adjust the distance between the jaws when closed, so as to suit the required reduction of the substance under treatment, the eccentric rod is bifurcated at its upper extremity to receive the bearings of the eccentric which are secured by gibs and cottars, while on the opposite end is fitted a block to receive the ends of the toggles This block is movable along and adjustable on the rod by a worm, worm-wheel, and nut ; or keys may turn the nut, which

is fitted on the screw-threaded end of the rod. Two or more rods may be fitted to a single toggle block.

3. The heads of the toggles may have a concave shape, and spherical or convex portions may be formed on or attached to the movable jaw, the rocking lever or eccentric rod, and the frame, so that the heads of the toggles shall partially surround instead of entering the said portions with which they work. Or the toggle creases may also be concave, and renewable round iron or steel bars be interposed between them and the concave heads of the toggles.

4. A throttle or stopping and starting valve, adapted for the engines of stone-breaking machines and for other engines, is described.

[*Printed*, 6*d*. *Drawing*.]

A.D. 1877, November 7.—No. 4142.

THOMPSON, William.—Pan for melting lead.

To obtain the molten metal pure and free from dross or scum and to regulate its temperature (for use in making white lead), a melting-pan is constructed with three compartments, separated from each other by vertical partitions. Drawings show a main central compartment, communicating by an opening near its bottom with one of the side compartments to supply molten lead free from dross to the latter compartment, from which the metal is ladled. The other side compartment is supplied with the lead to be melted, and is kept cooler than the main compartment, with which it communicates by an opening governed by a plug, so that, when the lead in the main compartment becomes overheated, some cooler molten lead may be let into it. Jackets containing a non-conductor of heat, such as charcoal and whiting, are formed opposite the two side compartments to prevent their becoming overheated by the flues. A cover over the melting-pan keeps the lead from oxidizing, while a small pipe in communication carries away fumes to a chimney.

The invention relates further to the manufacture of white lead.

[*Printed*, 8*d*. *Drawings*.]

A.D. 1877, ... No. 4142*.

Disclaimer and Memorandum of Alteration to the Specification

of the preceding invention, filed January 13, A.D. 1882, by the Innocuous White Lead Manufacturing Company, Limited, the assignees.

Certain parts of the Specification outside the scope of the foregoing abridgment are disclaimed, and some verbal amendments are made.

[*Printed*, 4*d*. *No Drawings*.]

A.D. 1877, November 12.—No. 4230.

LAKE, William Robert.—(*A communication from Henry Wright Adams.*)—Kilns.

A kiln described for burning bricks may be adapted to the treatment of limestone, ores, and other materials requiring calcination. The walls of the kiln should be well built with mortar at the lower part, where they are thicker, while at the upper part the bricks may be laid without mortar, and the ends thoroughly plastered with mud or pug. Such walls are sufficiently tight, and cracking from heat is checked. A blast-supply pipe, shown in a drawing as running centrally across the base of the kiln and built into a wall, receives the inner ends of the hollow grate bars, the outer ends of which enter other pipes located in the opposite walls of the kiln. Connections with the last-mentioned pipes, controlled by valves, deliver blasts of air through nozzles into the ashpits beneath the grate bars, and into holes in the walls above the fire-doors. Firebrick arches filled with pigeonholes are built over the grate bars to keep the calcined materials from falling into the fires, and the said holes lead into these arches. The blast is heated in traversing the grate bars, which rest upon bearers. Beneath the grates are pans to contain water, the steam from which prevents the speedy melting of the bars and is partly decomposed by the glowing coals, combustible gases being formed. Through perforations in the under side of the bars streams of heated air are injected into the water in the pans, and aid in boiling it. The arrangements described provide for an intense combustion of the fuel. Partition walls, shown as built over the blast-supply pipe up to the arches, prevent opposite blasts from blowing against each other and driving the heat unequally to one side of the kiln. Jets of steam may be used. Flues in the floor of the kiln distribute the heat generated by the fires under the entire

bottom of the charge, while flues or recesses in the walls allow heat to rise up in contact therewith and so heat the materials. The kiln may be charged with larger stones on the floor, their size diminishing upwards and small stones being spread over the top, which is covered with three platting courses of burnt brick, breaking joint and containing vent holes. No flues need be built through the body of the charge, as the latter will contain spaces for the ascent of the heat. In calcining a charge, when the water smoke has passed off and the charge becomes sufficiently heated, the vent holes are gradually closed to convert the kiln into an oven. The crevices through the courses of covering bricks now constitute the only vents for the products of combustion and are very small, numerous, and uniformly distributed. Thus the rising heated gases are held under pressure under the cover of the kiln and fill all the interstitial spaces, the calcination of the top and sides of the charge being more perfect. Bevelled rings of brass or other metal may be used as packing-wedges to tighten the joints of the pipes above referred to. A slit is made longitudinally through the ring, so that, when the end of a grate bar with the ring on it is inserted into a bevelled hole in one of the pipes and the ring is driven home and wedged tightly, the slit closes up and the joint is made airtight.

[*Printed*, 10*d*. *Drawings*.]

A.D. 1877, November 14.—No. 4252.

VAUGHAN, Edward Primerose Howard.—(*A communication from Carl Adolf Gröbe.*)—Furnaces.

For heating melting or puddling furnaces, fuel is fed from a hopper into, and by means of a screw or other contrivance is forced through, a hollow cylindrical "extractor," heated by the waste heat of the furnace. Combustible gases are thereby evolved from the fuel, and the residue or coke falls into a "converter," wherein the coke is transformed into combustible gas by the action of air. The heated gases from the extractor and the converter pass together into the furnace chamber through a channel, wherein they are mixed with air which has been heated by waste heat. Thus the gases are burnt to heat the furnace. The chamber to be heated may be placed either above or beneath the extractor. Flux may be mixed with the

fuel to produce a slag with the ashes thereof; and if carbonate of lime be used, the carbonic acid evolved therefrom in the extractor will be converted into "oxide of carbon."

[*Printed*, 6*d*. *Drawing*.]

A.D. 1877, November 14.—No. 4264.

HUTCHINGS, Richard James, and JOHN, Thomas.—Cleaning tin, terne, and other metal plates.

The plates are passed through felt, sheepskin, or rubber-coated-rollers, into bran, sawdust, lime, mother of coal, &c. contained in boxes capable of receiving a reciprocating motion, or containing vertical or horizontal discs of square, oval, or round form, coated wholly or in part with sheepskin, and having a rotary or oscillatory motion.

The boxes may be of wood or iron, and may be provided with valves for the admission and withdrawal of cleaning-material and plates; the apertures for the latter purpose are lined with glass, polished metal or leather, to avoid scratching of the plate. Gas or steam may be used for heating, and guides are used to direct the plates.

The plates may also pass between two transversely-moving endless bands.

[*Printed*, 6*d*. *Drawings*.]

A.D. 1877, November 15.—No. 4272.

ELLIS, John Devonshire.—(*Provisional protection only*.)—Manufacture of ferro-manganese and spiegeleisen.

To remove carbon as completely as possible, the ferro-manganese or spiegeleisen, surrounded by oxide of iron, is kept at a red heat in a furnace.

[*Printed*, 2*d*. *No Drawings*.]

A.D. 1877, November 19.—No. 4323.

PIEPER, Carl.—(*A communication from August Kloenne*.)—Purifying furnace gases.

A scrubber, described with reference to the purification of coal gas, is also particularly useful for purifying blast-furnace gases from smoke and dust. In this case the gas is preferably passed downward through the layers of gravel or coke, which

should be kept thin to reduce the pressure of the gas as little as possible. The dust etc. will be washed out of the gas by the water employed, and removed through openings at the bottom of the apparatus. But little water being used, the gas is but slightly cooled thereby.

In the scrubber described, the coke (or gravel) rests on inclined grates, hurdles, or sieves, arranged one above another, so that the coke tends to slide down them. But the grates being inclined alternately to the right and left and their lower ends terminating at some distance from an opposite wall, the layer of coke on each grate rests partly upon that at the top of the grate beneath and partly against the wall, whereby the sliding down is prevented until, by opening a valve at the bottom of the lowest grate, the coke thereon is discharged. There is a reservoir at the top of the scrubber for introducing fresh coke without much loss of gas. Or, instead of the charging and discharging taking place at intervals, a slowly-rotating " creeper " or conveyer " may be employed in each case. The incline of the grates may be regulated by providing them with hinges, their arrangement may be varied, and they may receive a shaking, tilting, or other motion. Sometimes four grates, forming "a funnel or inverted frustrated pyramid," may be used in combination with an upright pyramid, consisting of four grates. A polygonal form may be adopted.

[*Printed*, 6*d*. *Drawings*.]

A.D. 1877, November 23.—No. 4422.

THOMAS, Sydney Gilchrist.—Refractory materials.

Refractory coherent and durable basic linings, containing but comparatively little silica, may be employed for Bessemer converters, to allow of a basic slag being formed therein. Ladles, into which the metal is run from the converters, should be likewise lined.

Limestone, magnesian limestone, or chalk (preferably aluminous) is finely ground and intimately mixed with about 10 per cent. of its weight of a solution of silicate of soda (or of potash) and a little water to form a pasty mass, which may be rammed round the converter like a gannister lining, or may be first made into bricks. The bricks should be thoroughly dried, but not fired, before being used to line the converter, and they

are set in a basic cement. Alumina, oxide of iron, and silica, when present in the limestone or chalk, act as cementing-materials, but their proportion must be restricted to avoid fusibility of the lining and, in the case of silica, to prevent impeding the slag from becoming basic.

Magnesia may replace the limestone. Alumina, as in the form of emery, with the silicate of soda and 5 or 10 per cent. of clay, may be used either as highly-fired bricks or for ramming.

Calcined plaster of Paris, burnt lime, bauxite, and a little graphite or coke dust might be used in different linings.

[*Printed*, 4*d*. *No Drawings*.]

A.D. 1877, November 27.—No. 4453.

TAYLOR, Rees.—Cleaning tin or terne plates or other metal-coated sheets or plates.

Bran, sharps, pollard, sawdust, lime, chalk, whiting, &c. may be used as the cleaning-material. Means are provided for mixing the material, which is introduced through perforations in the upper of two reciprocating cleaners from a hopper to which it is again returned from an elevator. The cleaners are coated with sheepskin, leather, or rubber, and receive a continuous or intermittent reciprocating motion from eccentrics. The pressure on the plate may be adjusted by counter weights, springs, or screws.

Previous to passing the plates through the apparatus, they may be dipped in a mixture of sawdust and lime contained in a box mounted on centres as already described.

[*Printed*, 6*d*. *Drawing*.]

A.D. 1877, November 28.—No. 4486.

HEATHFIELD, Richard.—(*Provisional protection only.*)—Coating sheet iron with tin or lead or alloys of tin or lead.

One or two additional pairs of rollers are employed in the bath of metal, the planes containing their axes being at right angles to that containing the axes of the ordinary rolls.

[*Printed*, 2*d*. *No Drawings*.]

A.D. 1877, November 29.—No. 4499.

CAMPBELL, David, and SUMMERHILL, James.—Reverberatory furnaces.

Small coal or other fuel, contained in a preferably covered hopper which may be close to the end of the roof of the furnace, is gradually supplied through an inclined opening on to angled or horizontal furnace bars. A swivelling or sliding door or damper, fitted below the fuel in the hopper, may regulate the quantity supplied by gravitation; or a slowly-revolving vaned cylinder or drum may be employed. A sliding or hinged clinker grate may be fitted behind and below the ordinary firebars, and be moved at intervals to allow the ash and clinker to fall into the ashpit. Air is admitted to the burning fuel on the firebars through a grating, placed above them, and preferably having a controlling inlet door. The fuel gases pass over a flame bridge, which is formed hollow with perforated fireclay blocks communicating by pipes (in the hot brickwork of the furnace) with the hopper, "so as to convey "all gases or air from the fuel and hopper out through the "openings" in the bridge in a heated state to assist the combustion. Sometimes fireclay or other air-heating pipes may be fitted along the side walls of the furnace, or in its "escape back "flue," or through its floor or roof, to conduct air to the bridge, whence it issues to completely burn the gases, valves or dampers regulating the supply of air.

[*Printed*, 6*d*. *Drawing*.]

A.D. 1877, November 30.—No. 4516.

CAMPBELL, David, and SUMMERHILL, Isaac.—Coating metals.

Corrugated and other sheet metal are coated with hot coal tar or pitch, with or without resin, oil, and turpentine or other suitable drying-material.

[*Printed*, 6*d*. *Drawing*.]

A.D. 1877, December 7.—No. 4642.

WERDERMANN, Richard.—(*A communication from Ludovic Boblique.*)—(*Provisional protection only.*)—"Phosphoretted iron."

Iron ore may be smelted with a phosphate, as of lime, and sufficient silica to form a fusible slag. "The phosphoric acid "is reduced together with the oxide of iron." The product is iron containing a percentage of phosphorus, which varies with

the quantity and quality of the phosphate employed, and with the composition of the slag. When silica is present therein in excess, all the phosphorus passes into the iron, which may contain up to 25 per cent. of phosphorus. Thus iron with a definite percentage of phosphorus may be obtained from suitable proportions of ores and phosphates, or by melting pig iron with phosphuret of iron. The iron richest in phosphorus crystallizes in needles, and is porous and very brittle. Iron with not exceeding 12 per cent. of phosphorus resembles hard or white cast iron. With less than 4 per cent., the metal has a fine grain. These raw products also contain some "silica "and carbon." They are, therefore, melted and treated in a reverberatory furnace or in crucibles with non-silicious refining-fluxes, preferably mixtures of alumina with lime, magnesia, baryta, strontia, and the like, peroxide of iron, cryolite or fluoride of calcium, chloride of sodium, and carbonate of soda, oxidation by contact with air being checked. Very hard metal, resembling steel, is obtainable.

To produce iron containing very little phosphorus, the phosphor pig iron is refined, preferably in a puddling-furnace, the quantity of oxide of iron in the flux being increased. Much of the phosphorus is oxidized and passes as phosphate of iron into the slag. By puddling, the phosphorus may be reduced to 0·15 or 0·1 per cent., giving a metal well suited for rails, axle bearings, etc. The metal, being very sonorous, may be used for bells, and is also suitable for forming permanent magnets.

[*Printed*, 2*d*. *No Drawings*.]

A.D. 1877, December 8.—No. 4656.

GIDLOW, THOMAS, and ABBOTT, JAMES.—Puddling-furnaces.

"Furnace bridges and other parts of furnaces exposed to very "high temperatures" may be thus constructed.—The bridge is formed of a hollow metal casing, surrounded by brickwork. By means of a perforated pipe in the casing, jets of water are thrown against the internal top and sides of the bridge. The resulting steam passes through openings into the furnace and mingles with the products of combustion. Any water, not converted into steam, runs into the ashpit.

[*Printed*, 6*d*. *Drawing*.]

A.D. 1877, December 10.—No. 4683.

BROWNE, Alexander.—(*A communication from Edouard Fabre.*)—Re-heating, puddling, and similar furnaces.

Air for combustion is to be effectually heated (so as to economize fuel) by means of an apparatus, placed beneath the sole of the furnace, and consisting of vertical and horizontal partitions of cast iron or other good conductor of heat, which form narrow passages for the air "in contact with extensive "surfaces heated by the radiant heat of the furnace sole." The air circulates through the passages, and becomes hotter and hotter as it rises and approaches the fireplace. The partitions may reach to the under side of the sole, and, if made very thin in contact therewith, this will check the cooling of the sole at the points of contact. The apparatus may be modified. To prevent the heated air rapidly deteriorating the bearers of the firebars, a cooling-current of water or other liquid may circulate in contact therewith.

[*Printed*, 6*d*. *Drawings*.]

A.D. 1877, December 10.—No. 4684.

SCHULZE-BERGE, Hermann, and BARNSTORF, Julius. —"Extracting phosphorus from iron, steel, and other similar "metals."

The invention is described with reference to the dephosphorization of molten iron, which is effected (together with the removal of sulphur and silicon, while the carbon present is left) by the action of fused haloid salts, (chlorides, bromides, iodides, fluorides, and cyanides), of the alkaline earthy metals in furnaces or vessels, wherein intimate admixture may be effected in the absence of air or other oxidizing-agents.

[*Printed*, 10*d*. *Drawings*.]

A.D. 1877, December 11.—No. 4695.

JOHNSON, John Henry.—(*A communication from Henri Prosper Olivier Lissagaray.*)—Apparatus for superheating steam and other purposes.

The invention may be applied in the metallurgical treatment of iron and other metals by employing at will a constant or uniform temperature with an oxidizing or reducing atmosphere.

The invention includes a superheater, wherein the combustion chamber which produces the superheating is a source of heat for extraneous use, as well as of the heat necessary for effecting the superheating, the temperature of the said chamber being determined by the combustion in a unit of time of a known weight of liquid hydrocarbon brought into contact with a known weight of air. The superheater comprises three vertical concentric cylinders enclosing two annular spaces, the outer one of which contains sand to prevent radiation of heat, while saturated steam to be superheated is passed through a regulating-valve into the inner one. Oil from a heated reservoir flows through a level regulator (the overflow from which is measured) and a regulating-valve to the bottom of the superheater, which contains a central inlet hole. Steam for injecting the oil is led through a pipe, supplied both from the superheater and direct from the boiler in connection with a regulating-valve. The oil enters one branch of a pipe, connected to the central hole, and the superheated steam another, the steam passing through a contracted part of the pipe so as to meet the oil in the form of a jet and inject it into the inner cylinder or combustion chamber, where it is distributed by a baffle-plate and dispersed among brass pins, which project up into the cylinder and aid in vaporizing the oil. The air for combustion passes from a gasometer through a regulating-valve into a pipe or tuyère, which is carried down the centre of the inner cylinder to near the brass pins, and has numerous perforations in its cylindrical part near its lower extremity and in a disc at its end. The air, heated in passing through this pipe, meets the mixture of vaporized oil and steam and combustion takes place. The products ascend, superheating the steam in the annular space, and may be led through a box containing a given weight of water with a view to calculating the temperature of the combustion by means of the superheated steam obtained from this water. The regulating-valves employed may comprise two chambers, communicating by means of various plug cocks in connection with holes of different diameters, so that the flow of fluid through the apparatus is regulated by allowing it to pass through one or more of the larger or smaller or through all the holes, each cock being either closed entirely or opened fully. The relation between the weight of the oil and of the air entering the combustion chamber may be varied to effect either

complete or incomplete combustion, so as to impart either oxidizing or reducing properties to the resulting gases.

The Specification includes further arrangements of apparatus and calculations in connection with the determination of weights employed and results obtained, as well as various other applications of the invention.

[*Printed*, 8*d*. *Drawings*.]

A.D. 1877, December 11.—No. 4712.

DEELEY, Frank, and GARBETT, John.—(*Provisional protection only.*)—Puddling, heating, and other furnaces.

Part of the gaseous matter leaving the furnace is passed a second time through the same, whereby any unburnt fuel contained in it is utilized. Pipes or tubes may lead from near the top of the chimney to openings on each side of the furnace, and the gaseous matter passing therethrough returns to the fireplace and there mixes with fresh air. Dampers or valves in the chimney and pipes control the return of the gaseous current. Thus fuel is saved.

[*Printed*, 2*d*. *No Drawings*.]

A.D. 1877, December 15.—No. 4775.

ROBER, Heinrich Gotlieb Bernhard.—(*A communication from Louis Schultz.*)—Furnaces.

For high-temperature metallurgical processes, such as puddling or welding, an artificial blast may be used with the apparatus described. The fuel is introduced so that it enters the grate or place where it is burnt from underneath or sideways by means of a spiral scroll or its equivalent, and it forms a heap or pile from the top of which the fuel is burnt and falls upon the grate or place where it is completely consumed. Stoke holes are arranged near the scroll for observing the fire and removing slag. Instead of a common grate, a solid one, modified for introducing artificial blast wherever needed, is used and stoking thus avoided, the combustion being more complete and smoke being burnt. There may be an inclined plane, a pipe in which the scroll turns, and a hopper the side of which has the same pitch as the scroll. The pipe connects the hopper with the channel and grate for the combustion of the fuel. The blast pipe may be in connection with the hollow bottom of the

inclined firegrate, and there are terraces and holes through which blast enters the fuel centrally. In drawings of welding-furnace "generators," there are shown "gas canals" leading away from a conical chamber (which resembles the upper part of a blast furnace). Blast pipes appear to terminate in the chamber just below where the fuel is introduced by means of scrolls.

[*Printed*, 6*d*. *Drawings*.]

A.D. 1877, December 17.—No. 4803.

ROBERTS, Martin Fenn.—(*Provisional protection only.*)—Amalgam.

A "solid alloy of zinc and mercury," for use as one of the elements of a galvanic battery, may be made by running together by means of heat equal quantities of zinc and mercury, and then introducing the product into, say, 7 parts of molten zinc, thus producing an alloy of 8 parts of zinc to 1 of mercury. The exciting-fluid of the battery has little or no effect upon the alloy when the battery is out of action, but when the circuit is complete there is an efficient action on the zinc.

[*Printed*, 2*d*. *No Drawings*.]

1878.

A.D. 1878, January 1.—No. 23.

CLARK, Alexander Melville.—(*A communication from Hiland George Hulburd.*)—Manufacture of solder wire, ribbon, or rod.

Molten solder, heated but little above the melting-point, is poured into a funnel-shaped kettle, having an outlet orifice of the size and shape of the intended wire or rod. Thus the solder passes in a continuous stream through the orifice and solidifies in a subjacent water tank, which is preferably circular, not less than 4 feet deep, and 3 feet in diameter. The kettle should hold 100 lbs. of metal and have a depth of not less than 8 or 10

inches of metal, that the temperature may be correctly maintained and the stream issue with force and solidity. The nozzle or taper tube containing the outlet orifice is removable, and different shapes and sizes of orifice may be used. The tube may be heated, as by a gas flame, to prevent its becoming clogged by the cooling of the metal. The solder should be made of lead and tin thoroughly mixed, without antimony.

[*Printed*, 6*d*. *Drawing*.]

A.D. 1878, January 12.—No. 163.

GIBBS, JOHN RICHARD.—(*Provisional protection only.*)—Pickling and swilling metal plates previously to their being coated with tin or the like.

This invention relates to an apparatus for pickling metal plates. A trough is divided transversely into three compartments or vats. In each of these is suspended a cage large enough to hold the plates to be pickled and the truck on which they are brought up. The cages for the second and third of these vats are made with two stages or floors, and are supported by cords passing over pulleys and worked by suitable gearing so that when one rises the other falls. The cage to the third vat has one floor, and is hung over pulleys balanced by a counterpoise. At the end of the apparatus at which is the first vat is a fixed table, and at the other end is a fourth cage which can be raised or lowered. To the framing where the fourth cage is situated two shelves are affixed, one at each side, at such a height as to be a little below the lower edges of the pickled plates when the carriage containing them is run on to the floor of the fourth cage. The first and second vats are filled with acid or pickle, and the third vat is filled with water. A truck of plates is run upon the lower table of the first cage and lowered into the vat. This brings the upper table of the first cage and the lower table of the second cage level with the fixed table. Another truck of plates is now run over the upper table of the first cage upon the lower table of the second cage, which is then lowered into the second vat, the first carriage being at the same time raised from the first vat. The truck and plates are run over the upper table of the second cage, upon the table of the third cage, which is then lowered into the water and raised out again. The truck and plates are passed between the shelves

on the floor of the fourth cage, which is then lowered sufficiently to leave the plates resting on the said shelves, and the empty truck is run back to be reloaded.

[*Printed*, 2*d*. *No Drawings.*]

A.D. 1878, January 15.—No. 189.

CLARK, ALEXANDER MELVILLE.—(*A communication from William Fawcett.*)—Ladles.

The ladle has nearly-vertical sides, flared outwardly at the top, and, by means of an inner wall, a vertical conduit is formed in the side. The conduit opens into the ladle near the bottom, and has an outlet lip at the top. When the ladle is tilted, the purer and denser metal passes from its bottom up the conduit and is discharged, while the lighter metal and scoria remain floating in the ladle.

In using a ladle shaped like a ram's horn or curved trumpet as previously proposed, the metal while being poured through the smaller end becomes chilled, which by the present invention is avoided.

[*Printed*, 6*d*. *Drawing.*]

A.D. 1878, January 17.—No. 215.

VAUGHAN, EDWARD PRIMEROSE HOWARD.—(*A communication from Andres Leopoldo Nolf.*) — Treating matts or metals, especially matts containing copper, silver, or gold.

Superheated steam, air, or other gaseous fluid is to be projected under pressure against a thin stream of the fused matt or metal, to effect its pulverization. Within a cylindrical furnace a plumbago crucible is set centrally by the aid of firebricks and adjusting-screws. The matt or metal passes in a state of fusion through an orifice in the bottom of the crucible, and descends exactly opposite the injecting-nozzle of a tube, which (according to a drawing described) is in connection with an induction pipe for the steam or other fluid, the latter being under a pressure of, say, 4 atmospheres and superheated to, say, 720° F. in passing through coils within the furnace. In a line with the said nozzle is shown a horizontal iron pipe, in which the pulverization takes place, and which has a bell mouth leading to a chamber for the reception of the pulverized matter. Fuel surrounds the crucible, and the gaseous products of combustion, being drawn down by the vacuum created by the injection of

the fluid, pass through the grate (consisting of a platform of fireclay pierced with holes) into the said horizontal pipe, where they contribute to maintain the temperature. There are also two small tubes for admitting hot or cold air into the same pipe. Readily-oxidizable matts or metals during pulverization also undergo desulphurization and oxidation, and generally sufficient air should be admitted to cause the sulphur to form sulphurous acid, which, escaping by a pipe from the chamber, may be used for making sulphuric acid.

[*Printed*, 6*d*. *Drawing*.]

A.D. 1878, January 22.—No. 289.

THOMAS, Sidney Gilchrist.—Refractory materials.

The inventor refers to his subsequent Specification No. 908, A.D. 1878.

Furnaces, in which open-hearth processes of making steel are conducted, may be lined with refractory basic substances, to allow of a basic slag being formed therein. Finely-ground highly-magnesian limestone, mixed with about 8 or 10 p.c. of its weight of a solution of silicate of soda, may be rammed round the bottom of the furnace to form the hearth. This magnesian limestone may be replaced by aluminous limestone, not containing sufficient alumina or oxide of iron to render it fusible, nor much silica. Highly-calcined magnesian lime bricks, made from magnesian limestone mixed with a little clay or highly-aluminous limestone, may be used for making the interior of the furnace or those parts which come in contact with the molten metal and slag. When silica bricks are used for other parts of the furnace, they should be separated from the basic materials by a layer of plumbago bricks, coke mixed with clay, and sometimes silicate of soda, or other non-fluxing refractory material.

Bessemer converters may be lined with similar magnesian lime bricks.

[*Printed*, 4*d*. *No Drawings*.]

A.D. 1878, January 24.—No. 318.

HIGGINBOTTOM, James, and HUTCHINSON, Edward.—Washing grain &c.

The grain is cast upon a revolving disc, which throws it off by centrifugal force into an ascending current of water. The

grain is thus separated from the stones, being carried upwards, while the stones fall and are removed from the bottom of the chamber by an archimedean screw or other suitable means. The water with the suspended grain escapes from the top of the chamber through a series of openings in its sides, into a trough and thence to a settling-chamber. Here the grain settles down and is removed from the bottom by an archimedean screw or otherwise, while the water is raised by a paddle-wheel or other suitable means to its original reservoir. The level of the water in the reservoir is maintained constant by means of an overflow sill. Rotating arms are provided to push light matters off the surface of the water into a spout.

[*Printed*, 1*s*. *Drawings*.]

A.D. 1878, January 28.—No. 360.

BRIN, Leon Quentin.—Decorating surfaces coated with tin, and other metallic surfaces.

This invention relates to the production of patterns on metal plates by irregular cooling, by the action of water, air, or steam under pressure and at any desired temperature.

The metal-coated plate is heated over a gas furnace until the tin &c. is in a state of fusion, and it is then rapidly placed over a vessel through the perforated top of which water is forced for the purpose of cooling the plate. Air or steam may be employed instead of water, but the results are then different. A tin bath may be substituted for the gas furnace, or the plate may be used as it comes from the bath after tinning.

Immediately after cooling, the plates are cleaned in an acid bath, so as to uncover the angles of crystallization. They are then thrown into fresh water, and are afterwards varnished and coloured if desired.

[*Printed*, 6*d*. *Drawing*.]

A.D. 1878, January 28.—No. 364.

MOREWOOD, Edmund.—Manufacture of tin and terne plate.

A continuous process for tin and terne plate making. Refers to Specification No 365, A.D. 1878.

The flux is a mixture of rosin, tallow, and other grease, or rosin, or tallow, either separately or mixed with other grease or together. A mixture of 67 parts of rosin, 23 of tallow, and 10

of palm oil is preferred. The flux is contained in a flux box containing fixed guides and also guides movable about centres and pressed at their lower ends by springs or weights against the fixed guides. Spaces are thus formed, preferably four in number, in which the plates are held in the flux till they obtain a suitable temperature, when each in succession is pushed down to rollers which convey them through the coating-metal In working with the fluxes above described the coating-metal must be kept at a high temperature, and special means are required to clean the finishing-rollers from scruff. A bath is provided for containing the finishing-grease, which is preferably a mixture of palm oil and tallow. Troughs beneath one or more pairs of rollers contain clean coating-metal, which washes off the scruff brought by the plates. These troughs are supplied by separate supply vessels contained in the grease bath, the metal in them being kept melted by the heat of the grease. The supply vessels may either be deep enough to dip into the metal in the pot, or be provided with metal fins or legs for the same purpose. The supply of metal to the troughs is regulated by slides. The finishing-grease in one form of apparatus rises to the backs of the upper rollers.

In one modification, there is an air space between the surface of the grease and the upper rollers ; in another, a pair of curved face plates is placed below the upper rollers, and washed by metal overflowing from the trough supplying the rollers above, or supplied preferably by a separate channel.

[*Printed*, 6*d*. *Drawings*.]

A.D. 1878, January 28.—No. 365.

MOREWOOD, Edmund.—Coating metals.

The invention mainly relates to a continuous process for producing tin and terne plates. The invention is however applicable in parts when the process is not continuous, and also when coating-metals other than tin or terne are employed. Refers to Specifications No. 1958, A.D. 1863, and No. 364, A.D. 1878.

The plates enter through a flux box, and are carried through the metal in the coating-pot by rollers and guides, and through the finishing-grease bath by finishing-rollers. The pot is divided into two parts by flues, which serve as barriers to obstruct the passage of heat from one part of the pot to the other. One part

is kept heated by a fire beneath, and the other part may be warmed when commencing work by a separate fire, but when in work the latter fire is extinguished, this part being preferably kept cooler than the other part by regulated air currents through the flues. The metal in the pot is above the conveying-rollers, which are thus clear of floating scruff. If any scruff is carried forward by the plates, a large portion of it rises to the surface and is retained in the space between the flues. The finishing-rollers are adjustable by screws acting through springs, and in the case of the upper pair through spring levers. Beneath the upper pair, and sometimes beneath others, are troughs containing clean coating-metal which washes off any scruff brought to the rollers by the plates, and there is grease at the back of the rollers. Two extensions to the finishing-grease bath are provided overhanging the pot, the grease in the central part resting on the metal in the pot. The bottom of one extension is at a slightly-lower level than the edge of the pot, which is cut away to receive it, so that by filling up the pot the metal can be caused to rise into this extension, and by raising a slide the surface metal can be allowed to flow out and carry with it the grease settlings &c. deposited by the undisturbed grease in the extension. The two extensions can be shut off by other slides from the central part, for convenience in cleaning and in warming on commencing work. Pipes to two taps enter near the bottom; one supplies grease, the supply being regulated preferably by a float in the extension, and the other is used for the outflow of thickened grease.

In a modification more suitable for terne-plate making, there is only one pair of finishing-rollers, and an air space is left between the finishing-grease and the rollers; in another, air flues for cold or hot air run along the sides of the grease bath, and face plates are fixed below the upper pair of finishing-rollers supplied with clean coating-metal by an overflow from the trough supplying the rollers, or preferably by separate channels from the store vessel.

Instead of working with a divided pot, two pots may be used, one hot and the other cooler, the plates being conveyed from one to the other by rollers, one of each pair being larger than the other to curve the plates, and provided with curved guides. The rollers are immersed in clean molten metal or in liquid flux.

[*Printed*, 8*d*. *Drawings*.]

A.D. 1878, January 30.—No. 392.

TREGONING, Thomas Henry.—Pulverizing ores &c.

The grinding is effected by "two circular plates of unequal "sizes, so fixed as to work out of centre of each other, and "making an excentric motion." The ore may pass from a receiving-hopper into a hollow cylinder above the upper plate (which may be the smaller of the two). The cylinder forms the boss or nave of this plate, and the ore passes between the two plates centrally from the interior of the upper one. By means of a weighted lever, combination of levers, screw, wedge, spring, or equivalent acting on the step bearing or socket for the spindle of the lower plate, this plate can be raised or lowered to adjust the distance apart of the two plates and the grinding-pressure. The eccentric motion forces the ground ore into a gutter or launder for removal by water or other means. The said step bearing may be a reversible socket with indentations to be used in succession as they wear. The upper plate receives motion by bevel gearing, an upright spindle being attached to the said cylinder. The lower plate may be free to revolve in its bearings, or may receive a positive rotating movement at a different speed to the upper plate. Dry and wet grinding are included.

In a modified arrangement, the upper plate is on a hollow shaft rotated by gearing. There is a stationary receiving-hopper, communicating with the interior of the shaft and with the hollowed-out part in the middle of the plates, which have renewable grinding-surfaces. For taking the ore from all parts of the hopper, the upper part of the hollow shaft has a bush, which on one side is splayed out, while otherwise cylindrical or nearly so. A central moving stem, passing through the hollow shaft and vertically adjustable, tends to spread the ore. A gutter, which forms a casing round the plates, empties itself into a trough.

[*Printed*, 6*d*. *Drawing*.]

A.D. 1878, February 2.—No. 438.

FOX, Samuel.—Furnaces.

To render furnaces, with firebars arranged in steps and having in front of such bars plates to receive the fresh fuel, suitable for heating steel and other purposes where frequent

closing (to retain the furnace in a heated state without the combustion of further fuel) is required and the cross bearers or supports of the bars and plates would otherwise become overheated and fail; the inventor forms these bearers hollow and keeps a cooling-current of water flowing through them, the circulation of the water being maintained by the aid of pipes.

[*Printed*, 6*d*. *Drawing*.]

A.D. 1878, February 6.—No. 500.

HOLLWAY, JOHN.—Treating sulphur and obtaining metals.

A current of superheated steam may be driven through pyrites contained in a retort, chamber, or vessel, which is set in a furnace and may be heated to 1500° F., whereby the sulphur combined with the iron in the pyrites is carried off as free crude sulphur and sulphuretted hydrogen, which latter may be utilized for precipitating sulphide of copper from cupreous solutions or may be treated to obtain sulphur. When cupreous iron pyrites is operated on in the retort, the residue consists chiefly of oxide of iron and sulphide of copper, from which copper can be extracted. When the pyrites is poor in copper, the greater part of one of the equivalents of sulphur combined with the iron may be distilled off as described, and the residue can be utilized as hereinafter explained, or exposed to the action of air and moisture, whereby sulphate of copper will be formed and metallic copper be obtainable by known means.

Instead of heating the retort externally, the steam may be introduced sufficiently hot to expel the sulphur, or sufficient external heat may be employed to fuse and keep the sulphides and oxides molten, and superheated steam be driven through them like air through molten crude iron in the Bessemer process.

The vapours may be passed through chambers to allow metallic and other substances (which might include arsenic) to deposit therein before separating the sulphur. To produce sulphur practically free from arsenic, the crude sulphur may be digested with a dilute solution of alkali or alkaline sulphide, thus rendering the sulphide of arsenic soluble, for removal by decantation or filtration.

[*Printed*, 4*d*. *No Drawings*.]

A.D. 1878, February 7.—No. 511.

BAGGELEY, Henry.—Firebricks.

The dried matter, obtained as described below, may be made into firebricks by being moulded and burnt, a small proportion of clay being added thereto. Sewage is elevated by a rotating wheel, having round its periphery a number of wirework or perforated buckets acting as straining-scoops, the strained solid matter being directed into a closed drying-chamber, which has heating-flues beneath its floor. The said matter is traversed by mechanical scrapers along the floor from one end to the other of the chamber, and is discharged in a dry state through an opening in the bottom at the farther end of the chamber.

[*Printed*, 4*d*. *No Drawings*.]

A.D. 1878, February 8.—No. 522.

YOUNG, William.—Purifying furnace gases.

For purifying (including the removal of solid and vaporous matters in suspension), the gases from blast furnaces, lead-smelting furnaces, Siemens' gas furnaces, etc., (by the aid of a fan or other device) may be passed through one or more valves so constructed as to divide them into "a thin stream or sheet," which on issuing impinges against "a margin or plate placed " opposite the edges of the valve:" while it is cleaned, by its own action or otherwise, to keep the passages clear. The valve may comprise a concave or mushroom-shaped metal sheet, turned perfectly true round its edge and fixed upon a central spindle or guide rod. It rests within the valve chamber upon a seating likewise truly turned. Around the seating and at a short distance therefrom, there is a conical ring or short tube, extending above the valve opening and perforated below the level of the opening. The gases raise the valve, escape in a thin stream over the valve seat, and flow against the concentric ring, through the perforations in which they pass, while the solid matters are precipitated. Again, a valve may be employed provided with slots in a surrounding ring or tube, rods being fixed at a short distance from the slots. Tongues, projecting from the valve, pass through the slots and bear against the rods, where suspended matters become deposited. Cleaning is effected by the rising and falling of the tongues. Also a valve may have perforated plates and conical pins, the gases lifting

the plates off the pins and escaping through the perforations, which are afterwards cleared by the pins when the plates fall thereon. Or a kind of "sluice valve actuated by a gas holder" may be used. A shower of water or other fluid may be employed to entangle and wash away finely-divided suspended matters, the valve being also capable of modification to form a scrubber and purifier.

[*Printed*, 8*d*. *Drawing*.]

A.D. 1878, February 9.—No. 544.

THOMAS, John Glyn.—Pickling and cleaning metal plates.

A travelling carriage on rails carries a yellow metal or other rack or cradle, which is raised or lowered in upright guides by means of a chain passing over a quadrant and actuated by counterpoised levers. Between the crossheads of the frame is a beam for suspending the cradle. The cradle is moved by train wheels over troughs containing the pickling-liquid and water arranged in a line below, and into which the cradle is successively lowered and worked up and down. The washing-trough is supplied with water through a pipe with conduits leading into the upper part of the trough, and at the bottom of the trough there are outlets so that a stream of water is passing through during the process and produces the requisite change of cleansing-liquid. This trough has a table for loading the rack with plates and discharging the same when finished; it consists of two movable bars on swinging brackets on each side of the trough, the bars being drawn in by a lever for the cradle and plates to pass up and down, and turned out allowing the cradle to pass between but leaving the plates on when finished. The troughs could be arranged in a curved line, and the cradle carried by means of a central crane with radial connections.

[*Printed*, 6*d*. *Drawing*.]

A.D. 1878, February 15.—No. 631.

THOMAS, Richard.—Manufacture of tin plates.

Relates to a method of automatically pickling and washing plates to prepare them for coating with tin &c.

Two wide drums are connected by a broad endless india-rubber band, which carries parallel strips of wood overhanging

the band and drums on each side. Each strip carries two fingers at each end, which act to convey plates along troughs placed below the endless band. The plates are automatically placed in position at one end of the machine, and at the other end a pair of rollers receive them and squeeze back the superfluous liquor.

[*Printed*, 6*d*. *Drawings*.]

A.D. 1878, March 2.—No. 845.

CADDICK, Daniel Richard, and LEWIS, Thomas.—Reverberatory furnaces.

The bottom of the chamber, in which metal is melted or heated, may be formed double or as a box, divided into compartments. Air from a blower is passed through the compartments, and, while cooling the said bottom, becomes itself heated and then enters the ashpit, which is enclosed. Thus heated air is supplied to the fuel on the firebars. When the box contains several compartments, the air may circulate through each in turn. Part of the heated air may pass into chambers, placed at the sides of the combustion chamber and acting as " clinker boxes " to prevent clinkering of the fuel to the brick sides " of the chamber. These boxes will serve as reservoirs of heated air, which then passes through passages " at the end and sides of the " furnace to act on the smoke and products of combustion." Passages may also communicate with a chamber in the firebridge for the circulation of air therein to aid in cooling the bridge.

[*Printed*, 6*d*. *Drawing*.]

A.D. 1878, March 2.—No. 846.

SHELDON, James Thomas.—Furnaces for heating and melting metals etc.

The fuel is charged into one or more horizontal or " inclined " retorts, or into a producer, having its back end, which is open, " connected to the ordinary furnace grate. Air flues are " arranged along the main flue from the furnace, which is " preferably carried in a culvert under ground. Cold air " passes through the said air flues (in which it is heated) to flues " formed around the retorts " (or producer). Thus the fuel in the latter is heated and gas issues therefrom into the grate. Openings are formed from the air flues into the grate, so that

hot air meets the issuing gas and thorough combustion takes place. After a time the fuel is pushed into the grate from the retorts, which are then re-charged. In a preferable arrangement the escaping products of combustion act directly on the retorts, and the heated air enters the furnace grate without first passing round the retorts. The products of combustion on their way to the retorts may pass along a horizontal arched flue between inner and outer air flues, and thus the air is heated. Drawings of this arrangement show the furnace chimney as built over the retorts.

[*Printed*, 6*d*. *Drawings*.]

A.D. 1878, March 2.—No. 859.

YATES, Edwin. — Brushing and cleaning the surfaces of galvanized and other metal plates.

The standards of the ordinary flattening rolls are fitted with brackets carrying revolving brushes. The plates are placed on a feeding-table provided with guides and are fed into the trumpet mouth of the apparatus either by hand or by feed rollers. The brushes revolve in an opposite direction to the rolls, to which the plates are guided. Brushes may also be placed upon the delivery side of the rolls, and two or more sets may be used.

[*Printed*, 6*d*. *Drawing*.]

A.D. 1878, March 6.—No. 908.

THOMAS, Sidney Gilchrist.—Refractory materials.

The inventor refers to his prior Specifications No. 4422, A.D. 1877, and No. 289, A.D. 1878.

Alumina and silica, when present in certain proportions in limestone (particularly magnesian limestone), or intimately mixed therewith as in the form of clay, aluminous shale, or aluminous blast-furnace slag, impart (after sufficient exposure to intense heat) strength and cohesiveness to form a satisfactory lining for open-hearth steel-melting furnaces and Bessemer converters. A little magnesia may be employed, or magnesia or its carbonate may replace the limestone. From 3 to 4½ p.c. of alumina, 6 to 8 or 9 of silica, and 1 to 2 of oxide of iron generally " represent the limits for the most favorable pro- " portions of binding material in a good lining material before

"calcination." The finely-ground and moistened lining-material is moulded into bricks under pressure. The bricks are dried slowly, and then fired for a considerable time at an intense white heat. The temperature should suffice to cause all the alumina and silica to combine with lime and magnesia. The kiln should preferably have a down draught, and the basic bricks be separated from the silicious floor by a neutral material like talc or steatite. The bricks should be kept dry, and, if they soon become tender, contain insufficient binding-material.

The hearths and sometimes other parts of open-hearth furnaces may be lined with the basic bricks, or with the basic material, the flame being then allowed to play long enough for the formation of silicates and aluminates of lime and magnesia to secure a compact lining before the charge is introduced. The furnace may conveniently have a hearth mounted on a carriage for removal and replacement by a fresh hearth.

Other materials, which might be added in forming the basic linings, include ore-furnace copper slag, hydraulic cements, natural silicates of magnesia, and borax. Carbonate of baryta might replace the limestone.

[*Printed*, 4*d*. *No Drawings*.]

A.D. 1878, March 14.—No. 1020.

HADDAN, Herbert John.—(*A communication from Samuel Thomas Owens and William McNair.*)—Furnaces for treating metals and ores.

The invention, which is described with reference to drawings of "a heating and puddling furnace," relates to providing a "hearth," which is "placed in a line with the waste products "of combustion, and upon which the fuel is first thrown, so as "to be heated from underneath by said products as they escape "up the stack." Also flues are arranged "to be heated by the "products of combustion and to continuously raise the tem-"perature of the air passing through them," the air thus heated rising into a chamber, whence it escapes through small perforations "over the top of the grate bars and reducing "chamber" [*i.e.* the working chamber] to thoroughly mix with the products of combustion and effect more perfect combustion. The "shelf or hearth" is placed "at back and above the fire-"box" to receive the fuel when first fed into the furnace, that

the volatile matter present may be driven off, the residual solid carbon being fed forward upon the grate to be converted into carbonic oxide, which is burnt in passing over the bridge. Sometimes air is admitted "through the front or side of the "walls above the hearth" to partly burn the fuel thereon. The sulphur in the coal is driven off, "and this sulphurous acid "mingling with the air over the bridge is at once driven off "before it can attack the metal or ore." Flues, traversed by the waste products of combustion, are arranged beneath the furnace in contiguity to one or more of the air flues. To produce a deoxidizing-flame the air is shut off from the flues.

[*Printed*, 6*d*. *Drawing*.]

A.D. 1878, March 14.—No. 1021.

HILLS, HENRY, and HILLS, CHARLES HENRY.—Treatment of calcined cupreous pyrites.

To extract, (from cupreous pyrites rich in iron and sulphur and containing but little silica), the copper and any silver and gold present, while much of the oxide of iron residue is rendered available for direct smelting in blast furnaces,—the calcined pyrites may be crushed and screened, using a mesh of from $\frac{1}{4}$ to $\frac{3}{4}$ of an inch. After separation of the dust from the crushed ore by a fine screen, the ore may be lixiviated with weak muriatic or sulphuric acid, or with hot water alone, and the copper in the resulting liquors subsequently precipitated by iron. Afterwards the ore is "classified and dressed by jigging "or other suitable water-dressing machinery" to separate "by "gravity the bulk of the kernel copper formed in calcination "and the unburnt sulphides of copper and iron from the rest "of the ore, which may be either smelted into regulus copper "or recalcined as at first." The part richest in copper may be smelted for the metal direct. It facilitates the extraction of copper if the ore which is sufficiently small to chloridize in the ordinary way be passed through the water-dressing process. Sometimes the said lixiviation may take place in the dressing process. The lightest part of the dressed ore may be roasted to oxidize the remaining sulphides and sub-salts, or mixed with salt and chloridized, and then again lixiviated. If the ore be oxidized, it may, after the copper is washed out, be mixed with a little salt or brine and again passed rapidly through furnaces to chloridize the precious metals, which can then be lixiviated out

and be precipitated by iron or otherwise, the precipitate, which may contain residual copper, being treated by any suitable method. If the ore be chloridized, the precious metals can be recovered by Claudet's iodide process or otherwise. The different sizes of classified ore may be treated separately or together, the separated dust being calcined or chloridized.

[*Printed*, 4*d*. *No Drawings.*]

A.D. 1878, March 18.—No. 1075.

CLARK, Alexander Melville.—(*A communication from Thomas Meiffren and Co.*)—(*Provisional protection only.*)—Alloys.

Substitutes for gold and silver in jewellery etc. may be produced.

An alloy resembling gold may be made by melting in a crucible pure copper, platinum, and tungstic acid, stirring and then granulating the molten mass by running it into water containing slaked lime and carbonate of potash (which render the alloy purer), and afterwards re-melting the granulated metal with fine gold, the resulting alloy being run into ingots. An alloy of red gold colour may be made from 800 grammes of copper, 25 of platinum, 10 of tungstic acid, and 170 of gold, the colour of the alloy varying with the proportions of the different metals. Boric acid, nitrate of soda, and chloride of sodium, previously melted together in equal proportions, may be used as flux.

To imitate silver or platinum, 65 parts of iron, 23 of nickel, 4 of tungsten, 5 of aluminium, and 5 of copper are used. The iron and tungsten are melted together and granulated as above described, and the nickel, copper, and aluminium are likewise melted and granulated, a flux of equal parts of boric acid and nitrate of potash covering the metals during melting. Sodium is introduced into the crucible to prevent oxidation of the aluminium, and charcoal to prevent oxidation of the copper. The granulated metals are afterwards melted together, and the alloy produced is run into ingots.

These alloys resist sulphuretted hydrogen and vegetable acids, and are but slightly attacked by mineral acids. They are ductile and malleable.

[*Printed*, 2*d*. *No Drawings.*]

A.D. 1878, March 21.—No. 1131.

HOLLWAY, John.—Separation of metalliferous substances from pyrites.

By treating pyrites, cupreous pyrites, and pyrites residues, with or without other metalliferous substances or slag-producing materials, the inventor obtains "as metals, or in the " form of oxides, sulphides, or as slag, the metals originally " contained in the pyrites and other substances." He employs " either a fixed furnace, such as a modification of the ordinary " blast furnace and the Bessemer converter, or a modified " Bessemer," air being driven in at or near the bottom of the furnace. Molten sulphide of iron may first be run into the furnace and afterwards the pyrites etc. be introduced. Part of the sulphur is driven off as free sulphur, and the sulphides then present undergo oxidation. "Sulphide of iron being oxidized " in preference to sulphide of copper, the latter always accumu- " lates" and the regulus is withdrawn when rich in copper: also the slag is withdrawn at intervals. The said oxidation produces the heat for continuing the operation. Materials are added, if needed, to form a liquid slag of such gravity that the copper regulus will collect beneath it when no longer agitated. Thus also there may be utilized substances containing such small quantities of valuable metals as to be unsuitable for ordinary treatment. The separation of the regulus and slag may sometimes take place after withdrawal or in another furnace. After withdrawing the regulus, but leaving heated slag in the furnace, more pyrites may be introduced. The copper regulus will contain the silver and gold present in the substances treated. Heated air may be employed and superheated steam may be introduced to aid the formation of free sulphur. Small pyrites may be utilized. The furnaces etc. may be lined so as to protect them from the action of the sulphides and oxides, and arrangements are provided for collecting and separating metalliferous substances carried over with the sulphur, vapours, etc.

[*Printed*, 4*d*. *No Drawings.*]

A.D. 1878, March 27.—No. 1216.

LAKE, William Robert.—(*A communication from Charles James Eames.*)—Finishing or forming a surface or coating upon sheet iron.

A black or blue-black glossy film or coating, which resists

corrosion and can be planished by rolling or hammering, may be produced by subjecting previously-cleansed iron sheets, while heated and before final rolling, to the action, first, of a solid, liquid, vaporous, or gaseous carbonaceous material, and secondly of steam at the temperature of incandescent solid matter. The sheets may be arranged, with spaces between them, within a closed casing just heated to redness. A jet of highly-heated vapour of petroleum or naphtha (with or without some steam) is then introduced, and a carburizing action takes place. Afterwards the said vapour is succeeded by incandescent steam alone for about 20 or 30 minutes. A longer period may produce a brittle coating of magnetic oxide, not susceptible of being polished. Subsequently a planished surface is obtained by heating and rolling piles of three sheets, the relative positions of which are interchanged at intervals to ensure uniform planishing. The mottled surface of Russia sheet iron may be imparted by using hammers with tesselated faces.

[*Printed*, 2*d*. *No Drawings.*]

A.D. 1878, March 29.—No. 1242.

LIVET, FOUNTAIN.—Furnaces.

In the case of smelting and puddling furnaces, beyond the melting-chamber "and across the draught" the crown arch is lowered down to a certain distance below the bridge; "and this "downward part of the crown flue is rounded," and "its lower "face in the flue over the expansion chamber" shown in a drawing "is horizontal to" the bridge: so that the heat may uniformly pass nearer the object to be melted.

The "divided fire-bars" employed "are a combination of top "bars and lower frames, both independent of each other, though "connected together. The former are simple" metal bars, "slightly tapered downwards and fitted at their top ends with "small downward noses" to retain them in position. These bars are in contact with the fuel, and their small weight and simplicity reduce the cost of renewal. The frames support the firebars proper and likewise have retaining-noses, the firebars being inclined. The frames heat the air passing between them before it enters the furnace, projections or flanges determining the distance to be maintained between them, and the bars have like projections.

[*Printed*, 10*d*. *Drawings.*]

A.D. 1878, April 1.—No. 1280.

BOWER, George, and BOWER, Anthony Spencer.—Protecting iron and steel from corrosion.

A protective surface film or coating of oxide or oxides of iron is to be formed upon the metal by the action at an elevated temperature of "carbonic anhydride," preferably produced by the combustion of carbonic oxide, which may be burnt to furnish heat for the process. The metal is advantageously coated slightly with sesquioxide of iron, or rust, before being exposed to the carbonic anhydride. The process may be modified by first using carbonic oxide with an excess of air to form a coating of sesquioxide on the metal, and afterwards employing carbonic oxide alone to reduce the sesquioxide to magnetic or black oxide. The "operations may be continued as often as "necessary according to the thickness" of film required.

[*Printed*, 4*d*. *No Drawings*.]

A.D. 1878, April 2.—No. 1293.

BENSON, Martin.—(*A communication from Silas Covel Salisbury.*)—Heating furnaces by gas.

The invention partly relates to the manufacture of gas from oils, a drawing of a puddling-furnace being shown as fitted with arrangements for burning the gaseous fuel. In this drawing inclined pipes or nozzles project downward over the bed of the furnace, being fixed above what is usually the firebridge. In making the gas, a supplemental current of hot air may discharge a liquid hydrocarbon into a jet of superheated steam and hot blast, whereby the vapour of the hydrocarbon is, in company with hot air and superheated steam under great pressure, heated sufficiently to decompose the vapour and produce carburetted hydrogen gas.

[*Printed*, 10*d*. *Drawings*.]

A.D. 1878, April 4.—No. 1348.

EDMUNDS, Henry, junior.—(*Provisional protection only.*)—Utilizing scrap or waste from tin and terne plate and other manufactures.

A rotating cylinder or drum is fitted with a cage, which is

packed with the scrap to be utilized, while the central chamber contains ignited fuel. On applying rapid rotary motion, an in-draught of air to the fuel is maintained. The heat generated fuses the coating-metal of the scrap, and the fused metal in the form of spray is discharged by the accompanying centrifugal action into the casing of the apparatus, thus leaving the iron.

If the heat be supplied from an adjacent stove, the temperature may be adjusted to requirements; as to prevent the volatilization of the metal, for instance, when zinc is recovered.

[*Printed*, 2*d*. *No Drawings*.]

A.D. 1878, April 15.—No. 1496.

GREY, John David.—Alloys for bearings of rolls and other machinery.

To produce less expensive and more durable bearings than those of brass, "a composition of spelter and tin or of spelter "and antimony" may be used.

[*Printed*, 6*d*. *Drawing*.]

A.D. 1878, April 15.—No. 1497.

FARMER, Charles Richard, and HARDWICK, Henry.—Calcining-furnaces.

A circular chamber has a horizontal bottom and arched top of firebricks, worked at the bottom corner into an obtuse angle, this angular part connecting the vertical wall and the horizontal bottom. There are fireplaces and flues. A rotating centre shaft, which passes through the chamber, has on it a boss, fast horizontally but loose vertically. Arms radiating from the boss carry V-shaped ploughs at different distances from the shaft, so as to travel in different circular courses over the horizontal bed. A footstep, vertically adjustable by a screw, carries the shaft, and so the ploughs can be raised and lowered. The shaft may be driven through wheel gearing by an engine, which is fixed on a double girder framing, forming a stay for the furnace side and cross girders. The forward movement of the ploughs stirs the ore and throws it into ridges and furrows, thus exposing a large and changing surface to the heat. By their backward

movement the charge will be drawn or emptied through a long opening in the bottom of the furnace, which opening is closed by an inclined slide plate running on rollers, a weighted lever being used for opening and closing the front of the slide-plate aperture. The shaft is shown in a drawing as passing vertically through the roof and bed of the furnace.

[*Printed*, 8*d*. *Drawings*.]

A.D. 1878, April 16.—No. 1526.

CLARK, Alexander Melville.—(*Daumesnil, Albert Paul Georges*.)—Composition and process for coating metals.

The composition consists of borate of lead, and precipitated platinum or similar metals, such as palladium, osmium, or iridium. The borate of lead is ground in water in a mill until it is easily held in suspension in water. Chloride of platinum is dissolved in distilled water, and ammonia added to it. The ammonia precipitates the platinum in a fine state of division. The ammoniacal liquor is decanted off, and water added. After decanting off this water, and the water from the borate of lead, the lead and platinum are united.

In applying the composition, the metals to be coated are cleaned and then dipped into the composition, and afterwards placed in a highly-heated muffle until the coating changes from a white to a black colour. The composition may be applied by a brush, the surface being afterwards subjected to the action of a gas flame. The metal is thus coated with a mixture of lead, platinum, and the metal coated.

[*Printed*, 4*d*. *No Drawings*.]

A.D. 1878, April 24.—No. 1654.

COX, Samuel Henry Fortnom.—Stamping ores etc.

A vessel, in which high-pressure steam is preferably used as the actuating-medium, is fitted with a trunk piston, the trunk being on the upper side of the piston and working through a stuffing-box in the top of the vessel ; thus the effective area of the upper side of the piston is less than that of the lower side. A piston-rod connects the said piston to that in a subjacent vessel or compressor, which communicates by passages with a

third and smaller vessel, the three vessels being preferably cylinders. The rod of a piston in the third vessel extends through its top, and is connected by a crosshead or otherwise to the rod or rods of a stamp head, which stamps the ore in an ordinary coffer. Side levers are connected by rods or links to a crosshead in the upper end of the said trunk, and valves, to admit steam or other fluid into the first vessel, are operated by tappets and bars connected to these side levers or crosshead. When steam is used, the side levers are also connected to the air pump of a condenser placed in a cistern and to a feed pump for supplying a steam boiler etc. The condenser is connected to the first vessel by a pipe provided with a valve. Steam is admitted into this vessel above the piston, which descends, and the piston of the compressor also descends, compressing the air beneath it. This air passes to the space below the piston of the third vessel, thus raising it and the stamp head. When the compressor piston descends, the air above it becomes expanded and a partial vacuum is there produced. Valves control the compression and expansion of the air. When the stroke of the piston in the first vessel is complete, valves allow the steam above the piston to pass beneath it, and owing to the greater area of surface on that side the piston is raised and with it the compressor piston, the piston of the third vessel being simultaneously forced down by the combined action of compressed air above it and partial vacuum beneath it, and the stamp head will strike the ore. When steam is used, the condenser assists its action. The compressor and third vessel are placed in a cistern of water to prevent injury from the heat produced by the compression of the air. Instead of a direct-acting cylinder and piston for operating the compressor, a crank or other mechanism may be used.

In a modification applicable to dry stamping, the air which actuates the stamp head is used for removing the stamped ore from the coffer. In this case (or for wet stamping) the driving-power may be applied to a pulley or gear wheel on a shaft communicating motion by toothed wheels to a second shaft, which carries cranks with rods, connected to a crosshead on the piston-rod of the compressor. The compressed air is forced into a chamber, which is fitted with one or more slide valves receiving the usual reciprocating motion through rods and levers from an eccentric on the second shaft. There is a

vessel having a piston-rod, connected by a crosshead to the rods of the stamp head as above described (or, in either case, the piston-rod may pass through the bottom of the vessel directly to the stamp head). Below the said chamber is a second chamber, which extends downwards and surrounds the anvil block, or terminates in the coffer above this block in pipes or passages. The compressed air passes from the first chamber through the said slide valve and the admission ports as usual, but, instead of being discharged into the air, is conducted into the second chamber, whence it enters the coffer and drives out the pulverized ore through openings and a passage into a receptacle. Between the two chambers is a valve, which can be adjusted to regulate the pressure of the air in the first chamber and the strength of the blows of the stamp head and its speed; any excess of compressed air passes into the second chamber and assists in driving the pulverized ore out of the coffer.

Steam may be used with or without a condenser; or water or other power may be employed with or without the steam engine.

[*Printed*, 6*d*. *Drawing*.]

A.D. 1878, April 26.—No. 1684.

WIRTH, Frank.—(*A communication from Heinrich Heun, II.*) —(*Provisional protection only.*)—Washing minerals and like materials.

Revolving or stationary drums, fitted with worms and beaters in such form that the materials to be washed therein are passed through in one direction and the water in the opposite, may be combined with an elevator having shoots or buckets for receiving the material from one drum and conveying it to other drums, and with water tanks for softening the material, for mixture therewith, and for washing the same. The beaters may be metal rods placed within the worms, which may line the sides of the drum. An ordinary elevator may be used with buckets or bags fitted to pass by, hold, and convey the material from one or more apertures in the drums.

[*Printed*, 2*d*. *No Drawings*.]

A.D. 1878, April 30.—No. 1729.

HADDAN, Herbert John.—(*A communication from Alexis Drouin and Joseph de Baxeres de Torres.*)—(*Provisional protection only.*)—Treating ores containing gold, silver, copper, and cobalt.

For the recovery of these metals, the ores are reduced to powder and treated with a hot or cold acidulated solution of marine salt, in order to obtain the chlorides of the metals in solution with the aid of binoxide of manganese. Casks having double sides and bottoms, covered with cloth which serves as a filter, may be used, the pulverized ore being held in suspension and stirred in the solution in the inner and upper part of the cask.

[*Printed*, 2*d*. *No Drawings.*]

A.D. 1878, May 3.—No. 1785.

HATTON, GEORGE.—Manufacture of tin and terne plates.

Pickling, washing, and drying metal plates.

The plates are arranged vertically and almost radially in circular frames attached to the ends of arms capable of revolving about a vertical axis. The frames can also be rotated from the central shaft by means of bevel gearing. The frames may be of copper, brass, or other metal. A circular rack formed upon the central part of the apparatus is engaged by a pinion driven through worm gearing, and thus the frames are raised from or lowered into the vats. The latter are arranged in a circle, so that any one frame may be successively immersed in all the vats. The number of frames exceeds the number of vats by one, so that a space is left in the place of one vat, for removing and re-charging the plates. Two vats may contain dilute sulphuric acid ; a third, an alkaline solution ; a fourth, hot water ; and a fifth, heating-pipes or gas burners.

[*Printed*, 6*d*. *Drawings.*]

A.D. 1878, May 7.—No. 1824.

DALTON, GEORGE.—Breaking stones etc.

Reference is made to the inventor's prior Specifications Nos. 293 and 4135, A.D. 1877.

1. To facilitate the renewal of the jaw faces, some ready means of fitting the faces is required. The inventor therefore casts recesses in the backs of the jaw faces, and fills the recesses with babbitt or other white or suitable metal, so as to project a little above the surface : and the jaw face will then be ready for fitting to the jaw stock or frame. A planed plate with inter-

vening packing-strips placed between the recesses may be cramped on to the back of the jaw face, and the said metal be then run into the recesses. By introducing such metal after the face is chilled all liability to warp or spring is avoided.

2. To draw back the movable jaw without the aid of a spring, the heads of the toggles may work upon or against steel rods, to which are fitted hooks attached to the toggles, so as to form an effective drawback for the jaw, recesses being provided for the hooks.

[*Printed*, 6*d*. *Drawing*.]

A.D. 1878, May 10.—No. 1881.

PRICE, Astley Paston.—(*A communication from Jean Emile Arthur B. de Langlade.*)—Gas furnaces.

In using gas obtained from coal, or gas obtained from combustibles charged with hydrocarburetted products, for heating gas furnaces (such as Siemens' regenerative furnaces) in which the waste heat is employed to heat the air or gas, or both, prior to combustion,—the gas is to be washed and cooled on leaving the gas generator by jets, spray, or sheets of water, introduced into vertical and horizontal tubes or passages which are traversed by the gas on its way to the furnace. Any excess of pressure caused by the gas descending together with water through a vertical tube may be counteracted by the ascent of the gas through another vertical tube down which water descends. In a third tube, a jet of water meets the descending gas and falls back with it to the bottom. The washing removes the hydrocarburetted condensable products and carburetted dust, thus preventing the overheating of the furnace by hydrocarburetted products evolved from fresh fuel, and ensuring a uniform composition of the gas. Also ebullition due to carbonaceous particles becoming mixed with oxidized slag in the furnace will be avoided, together with the consequent obstruction of the passages between the working chamber and the chimney. The deposition of soot and tar in the gas passages will be also checked, and the advantages of using gas for puddling may be secured. The condensable products may also be more completely collected.

[*Printed*, 6*d*. *Drawing*.]

A.D. 1878, May 14.—No. 1928.

ARCHER, Thomas, junior.—Crushing hard substances.

Reference is made to the prior Specification No. 456, A.D. 1867, which relates to machinery for breaking ores etc.

A revolving roller is combined with a squeezer, to which is imparted a crank motion applied at the top (by means of an eccentric on the driving-shaft) in such manner as to give to the squeezer a downward and a forward motion, thereby clawing and breaking the substances as they descend in the space between the roller and squeezer and are carried round by the turning of the roller. The operating-surfaces of the roller and squeezer are fluted or serrated, and so arranged that the projections on the one can pass into the spaces on the other. The squeezer consists of a vertical plate, curved at the upper part and having a hard chilled iron or steel face. This plate is fixed to a carrier, the upper part of which receives motion from the said eccentric, while the lower part is forked or slotted so that it can vibrate on a spindle fitted in the frame of the machine, and provided with a weighted safety lever or spring for yielding if required. The roller is driven at reduced speed by means of a pinion on the driving-shaft, gearing with a spur-wheel on the axle of the roller. The movable jaw or squeezer may be formed in more parts than one, to move forward alternately in accordance with the prior Specification.

Grinding-rollers may be placed beneath the crushing-apparatus described.

[*Printed*, 6*d*. *Drawing.*]

A.D. 1878, May 20.—No. 2017.

LAKE, William Robert.—(*A communication from Nathaniel Shepard Keith.*)—Refining impure lead with the separation of gold, silver, etc.

Commercial impure lead, pig lead, or "base bullion," preferably in sheets, may be used as the anode in an electrolytic bath or solution of acidulated acetate, chloride, or nitrate of lead, sheets of copper, brass, lead, or other metal or carbon being used as the cathode. On the electric circuit being completed, lead is dissolved from the anode and deposited in a pure crystalline form on the cathode, from which it may be removed for melting into commercial shape or otherwise utilized. Any

gold, silver, antimony, copper, tin, or the like present in the the anode remain undissolved, and, in the form of powder, drop into or are retained in receptacles, to be removed for subsequent refining or melting. Heat may be applied to the bath, and its acidulation prevents the formation of sub-salts and oxides, which would interfere with the electrolytic action. Other solutions may be used, such as of oxide of lead in a solution of caustic soda, or an acid, neutral, or alkaline solution of sulphate of lead dissolved in solutions of the various acetates and chlorides of the alkaline metals. Two or more baths may be applied in a series by electrically connecting the cathode of the first to the anode of the second, and so on.

[*Printed*, 4*d*. *No Drawings*.]

A.D. 1878, May 25.—No. 2100.

HOPKINS, John.—Annealing-pots.

The inventor makes the top and sides of one plate, but the top or roof is bent to a domed or curved form. This form strengthens the pot and resists heat. The ends are simply welded on at the joints to the top and sides. The pot may also be constructed with "the sides and ends of one plate bent " to the required form, and the top of a separate plate carefully " bent on a mould by hammering or otherwise formed." Afterwards the top is "placed in the pot and carefully welded " all round." In this case the hollow formed by the peculiar shape of the top is filled with sand or an equivalent "to prevent " the top dropping by reason of great heat" and to preserve the upper plates in the pot from injury.

[*Printed*, 4*d*. *Drawing*.]

A.D. 1878, May 28.—No. 2123.

LECHESNE, Octave.—(*Provisional protection only*.)—New white metal.

A mixture of 650 parts of copper, 275 of nickel, 25 of zinc and tin together, and 50 of cadmium, is specified. The quantities of zinc, tin, and cadmium may be varied according to the homogeneousness or whiteness desired, but the use of a certain quantity of cadmium is expressly claimed.

[*Printed*, 2*d*. *No Drawings*.]

A.D. 1878, May 29.—No. 2135.

PITT, SYDNEY.—(*A communication from Lewis Crooke.*)—Tin-coated lead projectiles.

Lead shot are taken from the cistern of the shot tower before they have had time to become oxidized, and are treated either simultaneously or consecutively with an acid solution of a salt of tin and with agitation sufficient to burnish them. The solution of tin is made of crystallized proto-chloride of tin dissolved in water, commercial nitric acid being added. The shot to be treated are charged into a tumbling barrel or other agitator lined with glass, acid solution being added to fill the interstices between the shot and just cover them. The tumbling barrel is agitated until a thin coating of metallic tin is deposited from the solution upon the shot.

A solution of tin for coating or plating may also be prepared by dissolving proto-chloride of tin and chloride of sodium in water to which hydrochloric acid has been added, and heat may be applied by introducing steam into the tumbling barrel through trunnions. Another solution is obtained by dissolving crystallized proto-chloride of tin in water containing hydrochloric acid, and by then adding a solution of bitartrate of potash acidulated with nitric acid.

A solution suitable for electroplating the shot may be made by dissolving in water, pyrophosphate of soda, and by adding to the solution crystallized proto-chloride of tin. This solution may be used in connection with metallic zinc without a battery. In this case the shot to be treated are charged into an ordinary tumbling barrel with a sufficient quantity of solution to cover them, and with a quantity of granulated zinc. The shot are then agitated until the coating is effected. Or in place of charging zinc into the tumbling barrel, the latter may be formed of or lined with zinc.

[*Printed*, 4*d*. *No Drawings.*]

A.D. 1878, June 4.—No. 2232.

LESTER, WILLIAM.—Stone-breaking machinery.

In machines for breaking between a movable and a fixed jaw or crushing-surface, the movable jaw may be suspended upon an axis supported by the side framing of the machine. At the back near the lower end of this jaw, another axis revolves in

bearings in the side frames and carries flywheels and a driving-pulley. An eccentric on the central part of this axis imparts a to-and-fro motion to the movable jaw either by acting directly on the back of the jaw or by means of a rod connected thereto. The fixed jaw is formed in one solid piece with a circular opening at each end, by one of which it is suspended on a bar supported in bearings on the side frames, and thus it can be easily reversed end for end and face for face to equalize the wear of the wearing-surfaces as required, and it is made to work with one face as a road stone-breaker and with the other as a crushing-jaw. The position or angle of the fixed jaw in relation to the movable jaw may be adjusted by a bar to be slid through openings in the side frames, so that the lower end of the jaw rests against the bar, the width of which can be varied to suit the angle required. There is an adjusting-screw to set the jaw. Or the position of the jaw may be adjusted by screws in the back of the frame. The working-faces of the movable jaw, which may be in two parts, can be reversed by being arranged to slide in dovetailed grooves or otherwise. A movable screen may be attached to the lower end of this jaw, which gives it a riddling motion, the dust being effectually removed.

[*Printed*, 6*d*. *Drawing*.]

A.D. 1878, June 6.—No. 2257.

GREY, John David.—Preparing sheet iron for the manufacture of tin and terne plates, or for galvanizing.

The iron sheets are dipped in dilute hydrochloric acid, drained, and passed through the furnace on travelling chains or their equivalents, which deliver to rolls from which the plates fall into a water tank. The plates are then dried by passing through a similar but cooler furnace.

[*Printed*, 6*d*. *Drawing*.]

A.D. 1878, June 12.—No. 2340.

BURGHARDT, Charles Arthur, ROWLEY, Thomas, and SALOMONSON, Arthur Critchley.—(*Provisional protection only*.)—Utilizing waste india-rubber.

Extracting zinc. A solution of rubber waste, in hydrochloric acid together with an aqueous solution of rubber waste, is treated in a vat with bicarbonate of sodium, soda crystals,

anhydrous sodium carbonate, ammonium carbonate, potassium carbonate, alkaline earth carbonates, caustic soda, caustic lime or its solution, or caustic potash, in order to precipitate the contained zinc &c. The precipitate is allowed to settle, and the liquid is run off, the precipitate being then levigated with water.

[*Printed*, 2*d*. *No Drawings.*]

A.D. 1878, June 13.—No. 2351.

JOHNSON, JOHN HENRY.—(*A communication from Henri Cabanes.*)—Separating or sifting machine.

Fine ores are among the granular substances, composed of particles of nearly equal volume and differing only in density, which may be purified and separated by the aid of an auto-pneumatic box supplying air under a uniform and steady pressure. The ascent of the compressed air through the layer of substances under treatment upon the separator carries up the lighter portions of the same. A shaft provided with cranks imparts motion to all the working parts. By the aid of springs an oval motion is imparted to the said box, which has four solid sides and a perforated bottom. The holes in the latter are covered internally with leather or india-rubber cloth secured at one side, to act as valves. The box forms a chamber for compressing air, and contains a working table or separator, to the legs of which springs impart an alternately ascending and descending motion in an opposite direction to the motion of the box. The table forms a detached false bottom of the box. Numerous valves in the bottom of the box are provided with slides to adjust the size of orifice through which the air is drawn. Openings in the table are connected to transverse openings in the fixed bottom of the box by leathern or cloth passages, which guide the purified substance under treatment to subjacent outlet hoppers and shoots, and prevent any entrance or escape of air from the box. A sieve fitted with silk or leather rests on a wooden frame, placed inside the box and covered with an obtuse-angled strip of zinc, the inclined portion of which has holes near the upper part for the passage of the compressed air. The strip is bent over at the lower part throughout its length, so as to receive a band of leather or cloth, which covers a rail fastened to the sides of the table and constituting a frame to the latter. The zinc may be replaced

by a strip of cloth, allowing all the air to pass underneath according to the work to be performed by the separator. A strip of leather or cloth forms a counter valve. To check the adhesion of particles to the pores of the silk or leather with which the frame is fitted, and thus to prevent obstruction to the apertures which the surface of the sieve must present for the passage of the grits. A set of beaters, which consist of stretched cords working automatically at regulated intervals free the said pores. The beaters act upwardly with the com pressed air, a shock being produced throughout the thickness of the layer of substance under treatment. The arrangement for actuating the cords includes two transverse axes provided with arms, which are hooked to loops attached to short tubes. Through the latter are passed the (gut) cords, covered with wire and stretched over bars. A roller with a ratchet-wheel and detent serves for tightening. An endless moving chain imparts motion to the axes by a tappet in the chain coming in contact with a lever on one axis, a connecting-rod imparting the motion to another lever on the other axis. A small arc of a circle is described and the cords are drawn down. When the tappet releases the lever, the elasticity of the cords carries them up suddenly against the under side of the sieve and frees the pores. The apparatus has a cover and the lighter particles pass to an exit tube. Supplementary bellows, forming part of the box, may increase the supply and pressure of air. Devices ensure parallelism between the surface of the table and the sieve.

[*Printed*, 6*d*. *Drawing*.]

A.D. 1878, June 21.—No. 2470.

VAN GELDER, Pieter.—Sieving-apparatus.

To lessen the tendency of machine-worked sieves to choke, the material for treatment is thrown by a feed apparatus against a sloping or curved plate, down which it falls on to an inclined plane on the moving frame of the sieve. The material slides down the plane and falls into a hollow unperforated part of an upper sloping sieve. Under this sieve and moving therewith is a second (and, if needful, a third) sieve, while a subjacent tray with a spout leads away the sifted material. Other spouts are provided for the contents of the different sieves. There may be a second set of sieves below, sloping in the reverse direction

Two, three, or more sets may be used to separate different sizes of material, and fans can be employed to carry off the lighter particles. To actuate the sieves; "each frame, supporting a set " of sieves and tray (and the inclined planes also), is supported " at each end by a bracket and bearing," in which works a vertical crank "of a crank shaft, the two crank shafts working at the " same speed, the cranks on the two crank shafts being arranged " equidistant in angular measurement," *i.e.*, 180 degrees "apart " for two sets, so that the motions performed by the shafts " may be as uniform as possible"; the stroke of the cranks being proportioned to the size of material. Thus (or by a mechanical equivalent) every part of the sieves has an equal circular movement, and each particle of the material tends to be on its largest side and move sideways till it falls through the meshes or passes away over the lower end. The sieves etc. can be suspended in the frames adjustably to vary the height at one or both ends. In large machines, the frames may be supported " on the ends of additional pivots supported loosely in footsteps " or ball-joint sockets."

A.D. 1878. . . . No. 2470*.

Disclaimer and Memorandum of Alteration to the Specification of the preceding invention, filed April 18, A.D. 1888, by Pieter Van Gelder.

[*Specification printed*, 6*d*. *Drawing*.]

[*Disclaimer*, 8*d*. *Drawing*.]

A.D. 1878, June 22.—No. 2483.

INGRAM, HENRY JOSEPH, and INGRAM, GEORGE.—(*Provisional protection only*.)—Furnaces.

In the case of puddling and other reverberatory furnaces, the inventors "construct and arrange the parts substantially as " described with respect to" the following glass furnace:—A " gas generator consists of a chamber under the middle of the " furnace, into which chamber two inclined passages or shoots " open" for feeding fuel to the generator. The inclined sides of the generator are "formed of fire-bars, through which air " passes to support the low combustion of the fuel." The ash of the fuel closes the otherwise open bottom of the generator. The gaseous fuel produced rises through a central vertical flue into a chamber, which contains the glass-melting pots, and which

has an arched reverberating top with a series of small side chimneys arranged equidistantly. A set of radial flues supply air to the vertical flue to burn the gaseous fuel. The air becoming heated in traversing the flues, an intense heat is produced by the combustion.

[*Printed*, 2*d*. *No Drawings*.]

A.D. 1878, June 26.—No. 2572.

JORDAN, Thomas Brown, and JORDAN, Thomas Rowland.—Crushing ores etc.

The stem of each stamp head is fitted with a piston, packed with cup-leathers and working in a closed cylinder. The piston-rod below the piston is formed as a trunk of nearly the same diameter as the piston, so that only a narrow annular space is left between the trunk and the cylinder. The piston, stem, and stamp head are thrown upwards by a cam on a rotating shaft, and, as the trunk passes through a gland at the bottom of the cylinder and is packed with a cup-leather turned upwards, air is admitted during the upstroke but its discharge prevented during the return stroke, the piston being so packed that the air in question passes from the space below to the space above it and is added to the quantity of air in the cylinder. Thus the quantity in question would be constantly increasing were it not for an escape valve in connection with the cylinder. By controlling this valve by a spring and screw, the pressure of air within the cylinder can be regulated. The up stroke of the piston in the cylinder will greatly compress the air above it, and the compressed air will throw or drive down the stamp head and give increased force to the blows and rapidity of action, while the necessary weight of material in motion is reduced. The stamp heads are set in iron "covers" or boxes, having inlet passages for the mineral on one side, while the pulverized matter is delivered in front through gratings or the like.

The invention also relates to drilling, perforating, and laminating.

[*Printed*, 10*d*. *Drawings*.]

A.D. 1878, July 3.—No. 2658.

HESKIN, Thomas.—(*Provisional protection only*.)—Manufacture of magnesium.

Magnesic chloride is fused in an earthenware retort, but,

instead of employing sodium, hydrogen and carbonic oxide (or one of these gases) are passed through the retort and will combine with the chlorine of the fused magnesic chloride, leaving the metal magnesium. The hydrochloric acid thus produced may be used for converting a fresh supply of magnesic carbonate into magnesic chloride, and other bye-products may be utilized. The hydrogen and carbonic oxide may be obtained by passing superheated steam through heated coal.

[*Printed*, 2*d*. *No Drawings.*]

A.D. 1878, July 3.—No. 2659.

MÖLLMANN, Carl.—Cleaning wire.

Any oxide on the surface of rods and bars to be made into wire is loosened in the process of drawing, and may be washed away by a jet of soapy water or other liquid, which is in any case necessary to the wire.

[*Printed*, 6*d*. *Drawings.*]

A.D. 1878, July 17.—No. 2851.

SIEGLER, Berenth.—Separating tin from waste tinned plates etc., and obtaining copper.

Tinned iron scraps etc. are treated in a vessel or tank with commercial muriatic (or other) acid, whereby the tin is dissolved. When the acid no longer dissolves the tin readily, it is renewed " by heating it by means of steam or other convenient means, " which enables the acid to dissolve a further quantity of tin " from tinned plate " introduced into it, and this is continued until the weakened acid no longer dissolves the tin. On the bottom of the same or a fresh vessel the inventor places a little " copper ore, thereby enabling the acid to dissolve a further " quantity of tin." Before using the copper ore, a little prussiate of potash (sometimes with liquid ammonia) may be added. A more saturated solution of muriate of tin is obtained. " Metallic copper is also precipitated." By adding prussiate of potash (preferably with some liquid ammonia) all the iron in the solution is precipitated as Prussian blue, and afterwards the tin is precipitated as oxide by adding a solution of carbonate of potash, or by ammoniacal liquor. This oxide may be dissolved n sulphuric acid, and the tin be precipitated by metallic zinc or otherwise, preparatory to being melted. Or the precipitation

of the tin by metallic zinc may take place "at once," and the chloride of zinc produced be utilized. Again, a galvanic battery may be employed "to renew the strength of the said acid" and its action "will precipitate the tin held in solution by the acid "into crystallized tin." The residual iron scraps may be used for precipitating copper from solution. "The metallic copper "precipitated in the way described" can be melted.

[*Printed*, 4*d*. *No Drawings*.]

A.D. 1878, July 19.—No. 2880.

DOETSCH, HENRY.—Treating copper ores.

Pyrites is calcined or burnt in a furnace (preferably like a lime kiln with a domed top) communicating with a receiver for volatilized sulphur and with a condenser for sulphurous vapours. (A chamber like a sulphuric-acid chamber, but of wood, will answer, steam or aqueous vapour or spray being introduced in such quantity that a solution of the acid vapours collects at the bottom of the chamber, while the sublimed sulphur is deposited in the fore part of the chamber and may be sold.) The heat is obtained by burning part of the pyrites or other fuel, combustion being effected with as small an admission of air as possible. The sulphurous acid produced (without being transformed into sulphuric acid) may be used hot or cold, alone or in conjunction with chloride of sodium or of manganese or other chlorides, separately or combined, for dissolving the copper out of crude or unroasted ores by direct contact; and also be used for producing hyposulphite of soda, which may precipitate the copper as a sulphide easily reducible to metallic copper by fusion in contact with air. But a small proportion of the ore will require to be burnt to produce sulphurous acid, the remainder being treated in its crude state. The pulverized ore may be placed in tanks with the acid solution (preferably containing peroxide of manganese and common salt), and steam is blown in beneath a false bottom to agitate and heat the whole. In about seven days practically all the copper will have been dissolved, the iron and sulphur in the ore remaining almost untouched. The solution is run off, and the copper precipitated preferably by means of metallic iron and, where silver is appreciably present, it may be precipitated with metallic copper.

[*Printed*, 4*d*. *No Drawings*.]

A.D. 1878, July 19.—No. 2882.

DOETSCH, HENRY.—Treating copper ores.

Crude or unburnt ores, alone or mixed with calcined or burnt ores, and ground or pulverized, may be treated with hydrochloric acid, made specially or produced as waste liquor at alkali works, or *aqua regia*, and peroxide of manganese or of iron, the manganese residuum of chlorine works, or other oxidizing-agents, such as chlorine gas, chlorides, hypochlorites, or perchlorides, either alone or in combination, — nitrous vapours, nitric acid, and nitrates being also mentioned; or exposure of the liquors to the air may produce re-oxidation of the contained salts, and the spent liquors can be re-employed after replacing waste and re-oxidizing them. The treatment of the ore may take place in tanks, agitation and heat being applied by blowing-in steam beneath a perforated false bottom. Usually the copper is completely dissolved in about seven days. The solution is drawn off and the copper may be precipitated by metallic iron or otherwise. Gold and silver, when appreciably present in the ore, will be found in the solution and should be first precipitated by metallic copper or other agent. Samples of the ore for treatment are tested to ascertain the lowest proportion of acid capable of dissolving the copper, which proportion only should be used to prevent iron being unnecessarily dissolved.

Previous processes, known to the inventor, of using hydrochloric acid and an oxidizing-agent apply only to calcined or roasted ores.

[*Printed*, 4*d*. *No Drawings*.]

A.D. 1878, July 25.—No. 2956.

ORMISTON, JOHN WATSON.—Utilizing waste matter from coal washing.

The fine waste is suspended in a large quantity of water and is allowed to settle. After separating from the water it is dried and sifted, and may be used for "blacking" moulds for castings, and for mixing with the moulding-sand.

[*Printed*, 4*d*. *No Drawings*.]

A.D. 1878, July 26.—No. 2973.

EVERITT, William Edward.—(*Provisional protection only.*) —Regenerative melting-furnaces.

Midway between the two parallel regenerators, a row of equidistant small heating or melting chambers, suitable for the largest crucible to be used, is formed. Each chamber is connected to the regenerators by flues at opposite sides, the flues having dampers so that each chamber may be connected to either of the regenerators or disconnected therefrom at pleasure. Thus each crucible is heated independently and is not affected by the removal of others, and each chamber can be completely cut off from the furnace during the introduction and removal of its crucible, the rush of flame etc. from the chamber on the removal of its cover being avoided. Also the heat of the several crucibles can be better controlled. Furnaces for melting copper and brass are specially indicated.

[*Printed*, 2*d*. *No Drawings.*]

A.D. 1878, July 29.—No. 3009.

JENKINS, John Phillip.—(*Provisional protection only.*)—Apparatus to be employed in pickling and washing metal plates or other metallic articles.

The plates or other articles for tinning or galvanizing are packed in gun-metal cages provided with agitators worked by cams, and are lifted and dipped by hydraulic power in an acid bath combined with a washing-tank, so that the operations of loading and unloading, pickling, and washing may proceed simultaneously.

[*Printed*, 2*d*. *No Drawings.*]

A.D. 1878, August 3.—No. 3089.

LONGSDON, Alfred.—(*A communication from Alfred Krupp.*) —Metallurgical furnaces.

A "shaft furnace" may be constructed in tiers or stories, with the smelting-space high up and tuyères at different heights. Purification of the molten metal gradually proceeds as it descends through the furnace, which is charged with a view to the removal of certain impurities from iron. The furnace may have a portable fore hearth, which may act as a ladle for

conveying the molten metal to other furnaces for further treatment. The metal may run into the fore hearth through a central aperture in the cooled bottom of the shaft. Again, the "lower shaft" may form "the fore hearth of the upper shaft." An overflow arrangement for slag may separate it from the metal.

[*Printed*, 6*d*. *Drawing*.]

A.D. 1878, August 12.—No. 3192.

STENSON, Joseph.—Washing and separating ores etc.

A cylinder, preferably of iron but sometimes of glass, is fixed vertically in a frame and has on its top a hopper, divided across its centre into two nearly-equal compartments by an iron plate or diaphragm, which is adjustable to suit varying heights, the top end being a little higher than the hopper and the lower end a little above the upper end of the cylinder. To one side and near the top of the hopper a trough or launder is fixed to receive the ore, when crushed and sifted into portions of different sizes for separate treatment, the launder containing a spindle with twisted iron feathers or studs to be turned and urge the ore forward into the hopper for uniform feeding. A little lower than the centre of the other side of the hopper, and in the opposite compartment, a spout is fixed to carry off particles with the current of water flowing upwards through the cylinder. The lower end of the cylinder is fitted into the cover of a water-tight vessel or receiver, having a sloping bottom and a water supply pipe near its top, while a valve, plug, or door at the lowest part of the bottom may be opened at intervals for emptying the receiver. A stream of water is admitted into the receiver and upwards until it issues at the spout on the outlet side of the hopper, the velocity of the stream being adjusted to allow the heaviest or metalliferous particles to fall into the receiver, while the lightest or earthy particles are floated away through the spout. The supply pipe may be provided with a stop-cock or valve, having a figured index under the point of its lever, and with a pressure gauge to obtain a uniform result when the water pressure is constant.

Sometimes two or more of these separators may be connected to each other, so that the outlet spout of the first shall deliver its surplus contents into the launder or hopper of the next

below it, the velocity of the rising column of water in each consecutive separator being reduced by using larger cylinders in succession, or by diminishing the quantity of water passing through successive cylinders of equal size. Thus the heaviest particles collect in the first receiver, the next lighter particles in the second, and so on through the series, the earthy waste being floated away. The cylinders may be of square or rectangular form.

[*Printed*, 6*d*. *Drawing*.]

A.D. 1878, August 14.—No. 3216.

DAVIES, David.—Apparatus for coating iron plates with tin or other metal or metals, and for cleansing them.

Tram trucks bring cages of plates beneath a crane provided with five jibs, which place the plates successively in tanks with perforated bottoms, through which air or steam may be blown The two first tanks contain acid, and the last two water. In another arrangement, single plates are pushed through the vat by projections on a wheel driven by worm gear; suitable guides conduct the plates to the exit, where they are detached by a jet.

The plates are fed between guides, and are advanced through a passage to the grease pot by oscillating pendulous feeding appliances operated by cranks. The passage may be lengthened, and a grease pot provided at each end. The plates may also be fed by pistons, immersed friction rollers, screws, or a current of molten metal. For cleaning the plates they are fed by rolls between the faces of disc-shaped cleaning-appliances rotating upon hollow shafts. On the exit side are polishing-rubbers pressed against the plate by a weight and springs, or in place of rubbers rollers may be used. Bran is fed from a hopper through the hollow shafts to the plate, whence the centrifugal force passes it into a box, where the dirt settles and from which the clean material is returned to the hopper by a fan. In one modification, the bran is fed through the axles of two perforated cylinders, between which the plates are passed. Various forms of wheels and modes of driving may be used, or they may be replaced by a bran blast operating against each side of the plate.

Instead of a top and bottom jet, two top ones may operate upon a plate resting upon an endless band.

[*Printed*, 8*d*. *Drawings*.]

A.D. 1878, August 16.—No. 3237.

PARNELL, Edward Andrew.—Manufacture of zinc.

In preparing zinc oxide for the manufacture of spelter (or other purposes where purity and whiteness are not essential), the inventor employs the crude solution of zinc sulphate obtained by the lixiviation of calcined zinc ores, with or without the addition of sulphuric acid, and in obtaining the zinc oxide he uses small coal as the reducing-agent, one part of coal to about 10 parts of dry zinc sulphate or 18 of crystallized sulphate. This mixture is heated to dull redness in a close muffled furnace or an earthen retort. Or an open reverberatory furnace may be used, if excess of atmospheric oxygen be avoided; in such case a little extra coal should be added to the zinc oxide occasionally, so long as the addition causes disengagement of sulphurous acid. Again coal gas, gas from Siemens' "producer," and vapours derived from volatile compounds of carbon and hydrogen may be used instead of a solid reducing-agent, the zinc sulphate being introduced into the retort or close furnace in a dry and pulverulent state.

[*Printed*, 2*d*. *No Drawings*.]

A.D. 1878, August 16.—No. 3241.

DE LA PENOTIÈRE, William Paul.—(*Provisional protection only*.)—Crucibles.

To obtain increased heating-surface in crucibles for melting metals and in various other vessels, the bottom of the vessel is to be formed with a series of flutings, radiating from or near the centre of the bottom and rising up the sides of the vessel as far as desired. To permit the vessel to stand upright, its bottom may have a flat centre from which the flutings radiate.

[*Printed*, 2*d*. *No Drawings*.]

A.D. 1878, August 20.—No. 3274.

SUTHERLAND, William Seddon.—Gas furnaces.

Metallurgical furnaces are indicated. Mixed combustible gases and air in thin streams side by side may enter a furnace, which, according to a drawing described, may be elliptical in cross section and have an inlet opening at one side near the top; the said gases and air travel along the top, curve round, pass

backwards over the hearth, and as products of combustion leave the furnace by an outlet opening beneath the said inlet, a diaphragm separating these openings if desired. Thus the products of combustion pass away in contact with the entering gases and air, so as to heat them previous to combustion.

Mixed combustible gases and air in thin streams side by side may enter a furnace (made circular according to a drawing) circumferentially by a side opening, so that they shall have an involute course and travel round the furnace till they reach its centre, when they pass away by a chimney or flue. Thus the entering gases take up heat radiated from the centre of the furnace and carry it back thereto.

Mixed combustible gases and air in thin streams or layers side by side may enter a furnace at the bottom, in such manner as to pass upwards through the molten metal (or other matter) to be heated. Thus the gases will burn inside the metal and heat the same advantageously. A drawing shows a furnace working on trunnions like an ordinary converter : the inlet openings should be long narrow slits, in line and parallel to the axis of the furnace.

To prevent the flame passing backwards, should the forward motion of the gases not be greater than the back travel of the flame, diaphragms or valves may be placed at points where the passages, which convey the mixed gases and air, have a sudden bend ; the flame blows out the diaphragm and does not travel round the corner past it.

The invention also relates to generating carbonic oxide gas and to purifying heating or illuminating gases.

[*Printed*, 6*d*. *Drawing*.]

A.D. 1878, August 21.—No. 3297.

WILKES, John, and JOHNSON, Thomas.—Purifying or refining copper.

To effectually remove arsenic, antimony, and tin from Chili bars and other impure copper, so as to produce a quality equal to best selected copper, a more powerful action than that of air is employed to oxidize these impurities, which then enter the slag. With a charge of 7 or 8 tons of impure copper, melted in a refining-furnace, there may be thoroughly incorporated by rabbling 3 cwt. of a finely-powdered mixture of 6 parts by

weight of calcic hydrate (slaked lime) or soda-ash and either 2 of copper scale or oxide, 3 of hæmatite or peroxide of iron, or 3 of peroxide of manganese. Afterwards the furnace is closed, and the temperature raised until the slag is fit for skimming off. The process is repeated until the said impurities have been wholly removed.

The slag, containing the arsenic, antimony, and tin, with 20 or 30 p. c. of copper, may be smelted with a reducing-agent and the resulting copper cast into cakes ; or may be smelted with regulus or a sulphide ore of copper, using such proportions that the product will contain 50 per cent. of copper. In this case, after removing the slag, 6 cwt. of a mixture of 1 part of oxide of copper and 2 of soda-ash are added to 4 tons of the regulus. By rabbling, the said impurities are oxidized, forming salts of soda, which are skimmed off, thrown into water, and thereby dissolved, leaving any copper or copper compound undissolved.

The proportions given may be varied.

[*Printed*, 4*d*. *No Drawings.*]

A.D. 1878, August 23.—No. 3331.

NURSE, George.—(*Provisional protection only.*)—Preparing iron plates for coating or covering with tin, lead, or any other metal or alloy.

Relates to pickling, washing, drying, rolling, and annealing.

After pickling and washing in portable cages, both plates and cages are transferred to a drying-stove provided with a turn-table that may be rotated by a hand wheel. The stove may be dispensed with by forcing hot air between the plates in the cages. Gas may be removed from the plates, and blistering prevented by putting them in a second stove.

By first drying or cold-rolling, the plates can be annealed at a lower temperature. One annealing is sufficient, and a portion of the scale is burnt off.

[*Printed*, 2*d*. *No Drawings.*]

A.D. 1878, August 24.—No. 3334.

ATKINS, Thomas.—Metallurgical and other operations.

An injector is described with reference to drawings, and is capable of adjustment and regulation for injecting improved

compound gases and air at various pressures and proportions and forming a partial vacuum in connection with smelting metals, heating-furnaces, etc. A gas-supply tube from a storage chamber may pass through a stuffing-box into the tube of the injector, within which a central tube is mounted. Upon this tube a toothed pinion is fixed, and a screw on the tube passes through a fixed nut, so that, when a toothed rack moves the pinion, the conical end of the central tube can be adjusted finely within the conical end of the jet tube of the injector, to regulate the discharge of the gas or fluid therefrom.

Retorts are described for generating compound gases from a mixture of bones, shale, and coal, such gases being combined with coal gas for illuminating and other purposes. The compound gases may be purified by layers of a mixture of coke, bones, wood-charcoal, and shale, in combination with layers of lime. Compound carbonaceous materials may be compressed by cylinders and pistons (or mechanical equivalents) into globular, angular, or other forms, for use as fuel for generating gases of as nearly as possible the same specific gravity. Rotating or oscillating firegrates or furnaces described may be employed for generating compound gases. Chambers or vessels for storing the compound gases at various pressures are described.

Various other subjects are included in the Specification.

[*Printed*, 8*d*. *Drawing.*]

A.D. 1878, August 24.—No. 3353.

WIRTH, Frank.—(*A communication from Heinrich Hochstrate.*) —Sifting-apparatus with blowing attachment for dressing coal, ores, &c.

By a rotating drum-sieve the ore is sorted according to its size, and each size falls through a funnel-shaped catcher below the drum into an air current, produced by suitable apparatus and passing through a canal. The air carries all particles of dust into a dust chamber, while the larger and rounder grains fall upon an endless moving floor and roll away into a funnel. The heaviest or more flat pieces remain on the floor and are carried in the opposite direction to the air current into a hopper. The floor consists of chains with metal plates, which are of the same width as the length of the links riveted thereto ; it can be covered with a leather or india-rubber band containing indenta-

tions. For each size a separate canal is provided, each having an endless rotating floor, which rests on chain-wheels driven from a common axle. A sort of jumping action is given to the materials on the floors by shaking-apparatus beneath them. Each air channel is attached to a frame, the frames resting on the said axle at one end and carrying chain-wheels fitted with axles at the other. The frames have screws to regulate the incline of the said canals to suit different sizes of material, which also require different pressures of air. The dust chamber and hoppers have endless screws or other apparatus to remove their contents.

[*Printed*, 6*d*. *Drawings*.]

A.D. 1878, August 27.—No. 3381.

IMRAY, John.—(*A communication from Joseph Kasalovsky.*) —(*Provisional protection only.*)—Furnaces.

The invention, which is illustrated by drawings showing its application to a furnace for puddling or reheating, comprises a retort or chamber, wherein fuel is heated (before being fed on to the firegrate) by the combustion on the firegrate, and is supplied with some air, the combustible gases generated in the retort issuing through its opening or mouth to mix with the gaseous products and hot air over the firegrate, and being thereby consumed. The hot fuel from the retort is afterwards spread over the firegrate and undergoes complete combustion, the firegrate being thus kept covered with incandescent fuel. A grate may support the fuel in the retort, or there may be merely an opening exposing the side of the fuel, which then rests on a solid bottom; thus sufficient air is admitted to the retort to produce combustible gases but not complete combustion. In different cases the retorts may be vertical, horizontal, or more or less inclined.

[*Printed*, 6*d*. *Drawings*.]

A.D. 1878, August 27.—No. 3383.

EDWARDS, Henry.—Manufacture of firebricks &c.

Flint stones are thoroughly calcined in a kiln. The calcined flint is crushed, and then introduced into a pan, wherein edge-runners revolve, with sufficient nearly clear lime water to obtain a thorough mixing. Thus grinding and mixing are

effected, comparatively fine grinding being requisite in making crucibles and other fine goods, but lumps as large as filberts are permissible in the firebricks. The mass is afterwards removed through a sluice in the bottom of the pan. The plastic composition obtained is moulded, dried, and baked ; or is re-ground, when dry, to obtain a fire-cement. The lime should not exceed 3 p.c. of the mixture, as it is only used to make the composition plastic and binding, and enable the moulded articles to be baked hard in the kiln. Thus silicious firebricks may be obtained as capable of resisting heat as Dinas bricks, and these bricks will not swell in the furnace.

[*Printed*, 4*d*. *No Drawings*.]

A.D. 1878, August 28.—No. 3396.

REDFERN, George Frederick.—(*A communication from William Mann*.)—Reverberatory furnaces.

Hot-air chambers are placed at the sides and top of the fire-chamber, while a coking-chamber is arranged in front of and opens laterally into the fire-chamber. The heat from the fire-chamber heats the bottom of the coking-chamber, a heating-chamber in communication with the former being located beneath the latter. The fuel is charged into the coking-chamber, wherein gas is generated, and the coke is pushed into the fire-chamber and keeps up a live fire, so as to ignite the smoke and air together. The gas mixes with air from the hot-air chambers and is burnt, producing a flame of great intensity. Slack or fine coal may be wholly consumed. By thus decomposing the fuel nearly all the sulphur "is driven off in a gaseous "state, and thus sulphurous acid mingling with the air over the "fire is at once driven off before it can attack" the metal in the melting-chamber of the furnace.

[*Printed*, 6*d*. *Drawing*.]

A.D. 1878, August 30.—No. 3443.

RICHARDS, Tom Miles.—Cleaning tin plates.

The cleaning discs or wheels are faced with sheepskin, and are rotated in opposite directions upon vertical spindles by gearing, or by belts from a vertical shaft. The plates are fed by hand or rolls between the discs, and are removed by rolls.

Bran is supplied from a hopper and, after passing a regulating-valve, descends the hollow shaft upon which the top cleaner is mounted, the bran passing out to the surface of the plate through perforations in the face of the cleaning-disc.

[*Printed*, 6*d*. *Drawing*.]

A.D. 1878, September 4.—No. 3500.

BEAUMONT, Frederick Edward Blackett.—(*Letters Patent void for want of final Specification.*)—Direct-acting stampers worked by fluid pressure.

Reference is made to the prior Specifications No. 1149, A.D. 1874, and No. 1390, A.D. 1876, which relate to percussive rock drills worked by fluid pressure. According to the former of these Specifications, the cylinder ports of the drill are governed by a cylindrical slide, moved by the pressure of the working-fluid in accord with the movements of the drill piston, the valve casing having a central closed chamber and two end chambers open at their outer ends to the atmosphere; the central chamber contains a double piston and communicates at each end through ports with the drill cylinder, and the end chambers contain piston valves connected to the double piston by stems, and have ports communicating with the ends of the drill cylinder and other ports communicating with a fluid pressure supply pipe. The latter and modifying Specification includes arranging the piston valve in combination with cylindrical lining-pieces to the valve casing, so that the entire valve can be made in one piece; constructing the piston valve hollow and with perforations in its middle operating in combination with an annular passage in the valve casing, so as to serve as a passage for the exhaust of the drill cylinder; and constructing the drill piston-rod with a longitudinal passage communicating at one end with the atmosphere and at the other with an annular recess in the drill piston, so that such recess permanently communicates with the atmosphere.

The present invention relates to stampers for crushing ores etc., and consists in an arrangement of cylinder and slide in combination with a stamping-coffer and framing, steam or compressed air acting in the cylinder to cause the stamper rapidly to reciprocate. The reversals of movement are effected by the action of the working fluid itself on the slide without

extraneous mechanism, and the fluid is cut off when part of each stroke is effected, the rest of the stroke being effected by expansion. In vertical guides on a framing above the coffer are mounted a cylinder and slide, resembling in construction those to which the prior Specifications relate. A striker attached to the piston-rod stamps the ore in the coffer. By raising or lowering the cylinder by means of screws, the striker can be adjusted and wear taken up. For working expansively there is arranged in the supply pipe to the slide a double beat or nearly-balanced stop valve connected to a differential piston in a short cylinder. This cylinder communicates on its smaller side with the main steam pipe and on its larger with the main cylinder by a port arranged at the required point of cut off, so that when the main piston in its down stroke passes the port it admits fluid to act on the valve piston, closing the valve and so cutting off the supply of working fluid, and when the main piston rises the larger area of the small cylinder becomes open to exhaust through the main cylinder, whereupon the valve opens for supply of fluid to effect the next stroke of the main piston. The arrangements may be varied.

[*Printed*, 2*d*. *No Drawings.*]

A.D. 1878, September 6.—No. 3534.

EVANS, WILLIAM.—(*Provisional protection only.*)—Reverberatory furnaces.

A melting (and refining) chamber is placed between, and separated by bridges from, a puddling-chamber and the fireplace of the furnace. The melting-chamber is placed higher than the puddling-chamber, and the reverberatory arch of the furnace is correspondingly inclined, the flame passing over the melting to reach the puddling chamber. Jets of air, introduced by pipes passing through the crown of the arch, may be projected on to the metal in the melting-chamber. The air mixes with the gaseous products from the fireplace, promotes their combustion, and produces an intense heat. Also jets of steam may be used. The improvements apply to single or double furnaces.

[*Printed*, 2*d*. *No Drawings.*]

A.D. 1878, September 16.—No. 3638.

CLARK, ALEXANDER MELVILLE.—(*A communication from Emory Bassett Hastings and Robert Lewis Goddard.*)—Separating ores etc.

The ore is introduced into a space between a cone and a hollow cylinder, and passes beneath the lower edge of the latter on to an ore bed. The cylinder, which is connected to a nut on a screw, extends down towards the ore bed at the outer edge of the base of the cone, and the rapidity of feed is controlled by turning the cylinder up or down. The ore bed is of wire gauze on a ring-shaped frame, attached to the base of the cone. A subjacent revolving air cylinder carries two sets of radial pipes ; the outer parts of one set are bent to the rearward at an obtuse angle, and have in their upper sides longitudinal slits, through which blast escapes against the under side of the ore bed and, raising the ore from different parts in succession, moves it a little towards the outer edge of the bed. The lighter particles of ore will rise higher and fall more slowly than the rest, and a second alternating set of radial pipes are bent upward at the outer edge of the bed and then inward horizontally, and are inclined forward and have slits in their side to deliver a horizontal blast, which blows the said lighter particles against a flange on the upper edge of an outer inverted cone, placed below the parts of the apparatus described, and surrounding an inner inverted cone. The lighter particles descend through the space between these two cones, and pass out through discharge pipes into a receiver. The said space contains inclined chutes or partitions to guide the ore, and the air cylinder carries rods, bent upward at the outer ends, and supporting aprons with upwardly-bent edges, to convey the lighter particles over the inner cone and insure their passage into the space between the two cones. The heavier particles of ore drop from the outer edge of the bed into the inner cone and are guided by chutes therein to other discharge pipes. The fixed parts of the apparatus, as shown in drawings, are supported one above another upon a hollow post, in which a vertical shaft revolves. A gear wheel on the shaft works within the cavity of the post, and is in connection with a small gear wheel, pivoted to a collar upon the post and in gear with teeth formed upon the inner surface of the upper part of the air cylinder. The inner surface of this cylinder just below the teeth fits upon the outer surface of the said collar. The lower part of this cylinder is contracted to fit upon the post, the lower part of which is connected to a blast pipe, perforations through the walls of the post forming a connection between the

cavities of the post and of the air cylinder. The first-mentioned cone is recessed to receive the upper parts of the air cylinder and post, and also the conical upper end of the bearing on which this cone rests. In the apex of this cone is a hole containing the above-mentioned screw, which is hollow and serves as an oil reservoir whence all the friction surfaces are oiled; they are also protected from dust, the hub of the chutes in the inner inverted cone being extended upward around the lower part of the air cylinder to prevent dust from flying against the oiled surface of the hollow post. Surplus oil passing down the post is caught by a cup. Parts of the apparatus are adjustable, the bent parts of the second set of radial pipes being made in separate pieces connected by airtight couplings, so that by adjusting their ends the blast may receive the desired direction.

A like effect may be obtained by making the air cylinder stationary and the ore bed to revolve.

[*Printed*, 6*d*. *Drawing*.]

A.D. 1878, September 17.—No. 3663.

WISE, William Lloyd.—(*A communication from Aristide Balthazard Bérard.*)—" Gas blast furnaces."

A reducing or smelting furnace " consists of two reverberatory " gas furnaces, connected together so as to form a hearth " furnace, serving as an elaborating chamber for the re-actions " which the ores have to undergo: this portion corresponds to " the blast furnaces now in use. The sole or bed forms a " double crucible," and is movable for repairs. " On a middle " projecting portion rest the added fuel and the substances to " be reduced, contained " in a shaft or upright chamber. The metal reduced from the ore under the action of the mixed fuel and gases accumulates in the bed and is tapped off by either of two apertures. A grating may support the charge while a new is substituted for an old bed. The mixture of carbonic oxide and carbonated hydrogen employed is distributed by inclined tuyères, which are supplied centrally with hot air to burn the gases. The combustion first heats the two crucibles of the bed and then converges towards the shaft. The initial pressure of the gases or a partial vacuum in the furnace caused by an exhauster aids the working, hermetically closing doors etc. preventing either inward or outward leakage. " The arches

" are formed of cast-iron blocks (voussoirs)," lined with fire-brick and cooled externally by water. Magnesia, bauxite, or plumbago bricks can be used. The ore is subjected to the highest temperature under a reducing or neutral flame. The gases are afterwards utilized for generating steam and heating the air (under pressure) for combustion. The ore, fluxes, and sufficient solid fuel to absorb the oxygen of the ore are introduced through a charging hopper or chamber with a water joint and double closing flaps. The brickwork air-heating apparatus contains longitudinal passages with transverse iron heating-tubes, in which the air circulates: "they are thus " bedded in the masonry and protected from the action of the " flame." Their open ends terminate in a closed chamber. Asbestos joints at the ends of the tubes in the chamber prevent leakage and facilitate their replacement. A supplementary firegrate may aid in raising steam and heating the air. The gas generator has a double closing hopper and a chamber (wherein the gases are produced) with a replaceable bed and inclined blast tuyères. A "purifying regenerator" of the gases is employed, containing a movable bed and charged with incandescent coke mixed with lime, which raise the temperature, decompose steam, tarry vapours, and carbonic acid, and absorb sulphurous gases, superheated steam being also used. The claims include the method of cooling the arches of reverberatory furnaces. A special arrangement "allows of repairs and the " replacing of the flat arch blocks forming the base of the " construction and of their compression endwise to counteract" shrinkage from heat.

To extract precious metals, such as gold, silver, or platinum, while producing cast iron,—lead substances free from sulphur, such as the oxide or carbonate, are charged in with the ore. The quickly-reduced metallic lead " falls in small globules into " the middle and lower portion of the reducing shaft, effecting " a washing operation on the oxides of iron " and absorbing the precious metals. The lead passes to the lower part of the bed and continues to absorb precious metals from the fused iron in contact with it. This action may be aided by taking lead from a receiver forming an addition to the bed, and pouring it like rain on to the molten iron, through which it then passes. The rich lead is "tested (*coupellé*)," and the resulting litharge used again.

[*Printed*, 6*d*. *Drawings*.]

A.D. 1878, September 20.—No. 3729.

NOAD, James.—(*Provisional protection only.*)—Smelting and other furnaces.

Similar furnaces to those described below may be used for smelting other ores than those of iron, and for heating ovens or chambers wherein metals etc. are heated or melted, the furnace being formed so that the heated gases pass from the bottom through a flue leading somewhat downwards to a receiving-chamber, from which the slag can be drawn off at intervals, and from which the gases can rise into the oven or chamber to be heated. Two rows of such furnaces may be used on opposite sides of the oven or chamber.

Fuel and iron ore may be fed into the top of a smelting-furnace; "but the draft, in place of being upwards," is led "from the bottom of the furnace by a flue or channel sloping "somewhat downwards to a chamber," in which the slag and molten metal collect to be drawn off or further treated. The chamber has a chimney for producing the draught, and may have two communicating furnaces, one on each side. Tiers of openings round the sides of the furnaces may admit air for combustion at different levels. Products of the combustion of deleterious materials, like sulphur, in the fuel or ore may be withdrawn by outlets at a higher level than some of the tiers of inlet openings, in order to prevent contamination of the metal in the lowest and hottest part of the furnace.

[*Printed*, 2*d*. *No Drawings.*]

A.D. 1878, September 27.—No. 3819.

TAYLOR, William Henry Osborne, and WAILES, John. —(*Provisional protection only.*)—Hollow ingots or castings.

Molten metal is poured into a rapidly-rotating mould and its surface assumes the paraboloidal form, becoming approximately cylindrical if the velocity is sufficiently high.

[*Printed*, 2*d*. *No Drawings.*]

A.D. 1878, October 4.—No. 3914.

BAXTER, William Henry.—Stone-breaking machines.

To actuate the moving jaw of the machine, a rod conveys motion from a crank shaft or eccentric (mounted in bearings on the framework) to a "radial arm, moveable fulcrum, or lever"

the lower end of which is shown in a drawing as supported on the framework, while to its upper end are attached the said rod and also the "toggle" rods. As the shaft rotates, a "radial "reciprocating motion," by preference right and left at its top centre, is imparted to the said lever, and "during this move-"ment of passing over its centre" the toggle rods are lifted and lowered, thus giving the desired movement to the toggles and jaw. Another rod with a plate attached to the lever provides for the return motion of the jaw. A wedge-like movement being produced by the lever moving as described, less power is required for working the machine. Instead of a slow crushing motion, a hammer-like blow is given which more quickly breaks the stone. Lengthening the back toggle and shortening the front one increases the motion of the jaw.

[*Printed*, 6*d*. *Drawing*.]

A.D. 1878, October 8.—No. 3947.

SCOTT, George Lamb.—(*Provisional protection only.*)—Furnace for melting metals and alloys.

An outer metallic casing surrounds a chamber or heat generator, rectangular or otherwise in section, and lined with refractory material. This chamber has an opening (to admit fuel), closed by a metal lid covered by a fireclay block or shield, and at bottom has a shielded hinged door held up by a cottar or wedge (for "avoiding" ashes etc.). The shield or block covering the bottom door may have hollows or cavities to receive and form into ingots any fluid metal escaping from the crucibles in the melting-chambers. Pipes at the sides of the generator convey a strong blast of air into a cavity or air chamber communicating by small tuyère openings, formed in the refractory lining surrounding the interior, and so spaced at different levels as to effect complete combustion of the fuel without excess of air. The resulting flame and gases pass into one or more separate melting-chambers through openings near the bottom of the generator, which debouche into inclined channels extending right across the bottom of the melting-chambers. These are included in an extension of the lined metal casing, and are made oblong in section with rounded ends, or of other form. Thus the hot gases are uniformly distributed over the whole area and brought into contact with the metal itself or the crucibles containing it, and afterwards escape through orifices controlled by

dampers. Each chamber has a hinged lid protected by a fireclay slab (for charging etc.).

Again, the air admitted through the tuyères in the generator may be so regulated as merely to convert the combustible constituents of the fuel into inflammable gases. These are discharged into a gas or combustion chamber, into which sufficient preferably hot blast is introduced to effect the saturation with oxygen of the said gases. Sometimes to increase the intensity or quality of heat and flame, various hydrocarbons may be injected and mingled with the said gases or the solid fuel.

The blast may be heated by passing the products of combustion around pipes or channels enclosed in a chamber or flue, before these products escape into the chimney, the blast moving in a contrary direction to the escaping hot gases.

[*Printed*, 2*d*. *No Drawings*.]

A.D. 1878, October 9.—No. 3974.

LANCASTER, HENRY, and DIXON, THOMAS.—Alloy for steam traps.

The invention relates to that description of steam trap in which there is a comparatively-short tube having at one end an inlet box or chamber, and at the other a differential or equilibrium valve placed in a valve box provided with an outlet passage or nozzle, the tube being capable of expanding and contracting according to the temperature. To enable the tube to be expanded and contracted to the greatest extent compatible with strength, it is made of a special alloy composed of about 4 parts of copper to 1 of tin.

[*Printed*, 6*d*. *Drawing*.]

A.D. 1878, October 9.—No. 3975.

THOMAS, SIDNEY GILCHRIST.—Refractory basic materials for furnaces (and crucibles).

The inventor refers to his prior Specifications No. 4422 A.D. 1877, and Nos. 289 and 908, A.D. 1878.

Silico-aluminous magnesian limestone, containing preferably from 5 to 7 p.c. of silica, from 1·5 to 3 of alumina, and from 1 to 3 of oxide of iron, and the more magnesia the better, may be used for lining furnaces, particularly iron and steel furnaces,

when prepared as described. Aluminous non-magnesian limestone forms an inferior substitute. Blocks of the stone, after being dried at a low heat, are gradually raised to and kept at a very intense heat for many hours till they assume a dense, compact, hard, shrunk structure, all the silica, alumina, etc. combining with the lime and magnesia. The firing is followed by very gradual cooling, and access of cold air must be prevented throughout. The strong basic blocks so formed may be used with a basic cement, either with or without subsequent dressing, for lining Bessemer converters and open-hearth steel or other furnaces where basic slags are to be produced. Also the blocks may be ground with liquids to form basic cements or ramming-material. The blocks might also be used "for the manufacture "of crucibles for steel melting, which may be cut out of the "blocks before or after firing."

The kiln used for the firing may be lined with lime or silica bricks, and must have a down draught, which should be equally spread over the base of the kiln by forming a false bottom containing numerous flues. The fireplaces should suffice to produce a heat at least equal to that used in burning silica bricks, and the blocks are preferably not stacked higher than 4 feet.

[*Printed*, 4*d*. *No Drawings*.]

A.D. 1878, October 9.—No. 3992.

PETO, Samuel Arthur.—Plumbago crucibles and other vessels.

To dispense with the ordinary annealing process and improve the crucible by affording protection to the plumbago and preventing the crucible from absorbing moisture, which causes it to fly or burst when put into a furnace without being previously annealed, the inventor coats or covers the crucible with a compound, which may be applied with advantage before the crucible is baked (or afterwards before a second baking). The crucible is then burned and at the proper heat is "salted"; whereupon the compound will form with the salt a damp-proof and non-porous glaze, which will allow the crucible to be placed in a white-hot fire without previous annealing. The compound for the slip or coating may comprise about 12 parts by weight of ball clay, 2 of Cornish stone, 4 of burnt clay, 1½ of red clay,

ground and mixed with water to form a creamy paste, ½ part of manganese or its equivalent being added ; or about 12 parts of French clay, 2½ of Cornish stone, ½ of manganese, 1 quart of slip composed of 300 parts of China clay, 250 of ball clay, and 100 of flint ; or analogous compounds, provided the shrinking of the covering corresponds to that of the crucible. In lieu of the salt a pottery glaze may be used, or the compound may be so composed as to vitrify in the kiln.

[*Printed*, 4*d*. *No Drawings*.]

A.D. 1878, October 10.—No. 3998.

MESNIER, Jules Omer.—(*A communication from Messieurs Huet and Geyler.*)—Crushing hard substances, such as ores.

Reduction to grains, sand, or dust may be effected by two surfaces, one fixed and the other movable, the latter simultaneously rolling and sliding upon the former to produce a combined motion of crushing and friction, with capability of varying the duration of one or other movement to facilitate the crushing into fragments of any given size. The compound double rolling and sliding motion of a movable circular sector on a stationary one would be realized by making a circular arc roll on a fixed one having the same centre, the two radii being so chosen as to bear the relative proportion to each other which suits best between the rolling and sliding motions. As one circle rolls on another, the centre of the rolling arc will be displaced by describing an arc having same centre as the other round which it revolves. In a slight movement the middle of the rolling arc may serve as the centre of oscillation for the movable sector if it be allowed a slight free play for its horizontal displacement, the vertical displacement being insignificant Thus, instead of following two small epicycloidal arcs, this middle point would follow the tangent common to these two arcs. Between the centre of the movable sector and the point above chosen as the axis of oscillation there may be selected another point ; and, should the sector's movement also be very slight, the curve described by a certain such point during a certain period of its motion may be considered as a circular arc, the centre of which should be the fulcrum of a lever having the same length as its radius, the other end or any intermediate point thereof being driven by a connecting-rod the stroke of

which is thus limited by the length of the arc mentioned above. Again, a circular sector may roll on a fixed plane considered as a sector with infinite radius. Elliptical, parabolical, or other sectors would be suitable.

According to the description of the drawings, a circular sector rolls on a fixed plate and its axis of oscillation (which is allowed sufficient play for its horizontal movement) is placed in the middle of the ideal arc. At a point (which is on the radius between the centre of the circular arc described by this point and the axis of oscillation) there are linked in a common joint a lever, the circular sector, and a connecting-rod, which latter gives motion to the machine from a crank shaft. The throw of this shaft is so calculated that the course of the connecting-rod shall cause the above-mentioned point to describe the desired circular arc. The lever can oscillate freely in a socket, so that the centre of the said arc remains a fixed point. Sliding guides mounted at either end of the axis of oscillation have sufficient horizontal play to allow the small displacement of the movable sector. The fixed plate is adjustable by nuts screwed on a guide and rods, to regulate the space between it and the movable sector, and a spring regulates the resistance of the plate to being driven back when required to avoid breakage. The framing may consist of wrought-iron bars jointed together by blocks, while bolts and nuts or iron bands bind the whole together.

In a modified arrangement, the triple articulation of the connecting-rod with the two levers upon a single axle is replaced by knuckle-joints, the position of the centres of oscillation being so fixed as to obtain the combined crushing and frictional movement.

[*Printed*, 6*d*. *Drawing*.]

A.D. 1878, October 10.—No. 4001.

GRAY, DAVID.—(*Provisional protection only.*)—Breaking or reducing ores and stones.

In machines in which the ore passes down between a fixed and a vibrating jaw, the vibrating stroke may be made adjustable, so that when more easily broken materials are being operated on the stroke may be increased, and *vice versâ*. When the crank shaft is connected by short rods to the nipper end of

a vibrating lever or piece, the bottom of which forms part of the toggle couple acting directly on the vibrating jaw, the lever is centred or fulcrumed on a bolster or block bearing back against an inclined surface on the inner side of a block, which is adjustable vertically for determining the distance between the bottoms of the jaws : and the desired variation in the stroke is obtained by adjusting the fulcrum bolster up or down the inclined face of the block behind it. This adjustment may be effected by two screws, tapped through a cross-bar fixed beneath the bolster ; or wedges formed on the inner ends of long screw bolts, which pass through the back of the frame, may act on the under side of the fulcrum bolster ; and in either case wedge-ended screw bolts are applied to the top of the fulcrum bolster to assist in gripping it firmly in any adjusted position.

[*Printed*, 2*d*. *No Drawings*.]

A.D. 1878, October 11.—No. 4030.

JOHNSON, JOHN HENRY.—(*A communication from Auguste Séguin.*)—Metallurgical furnaces.

As improvements in the mode of heating the furnaces, to which the prior Specification No. 1770, A.D. 1877, relates, a hollow supporting bar (through which water circulates) may be arranged at the lower part of the grate to facilitate the clearing of the fire. For burning the gas in the combustion chamber, two air inlets are so arranged that the lower current of air ignites a part of the gas, thereby raising the last row of hollow bricks for the admission of the upper current of air to a white heat, whereby the perfect combustion of the gases is ensured. The heating-apparatus may be portable.

[*Printed*, 6*d*. *Drawing*.]

A.D. 1878, October 12.—No. 4043.

FOX, ST. GEORGE LANE.—Heating by electricity.

The inventor refers to his prior Specification No. 3988, A.D. 1878, which relates to electric lighting, including the construction of electric lamps with incandescent continuous conductors.

In heating by electricity according to the present invention, a coil of fine wire may be used, which will be more or less heated when the electric current passes through it ; the length

and thickness of the wire (or foil employed) determining the intensity of the heat. Platinum is suitable for use, but iron will answer. Or a larger conductor of some bad conducting refractory material, such as carbon (preferably graphite), may be used in conjunction with fireclay, magnesia, lime, or other refractory earth, to form an inner lining of a furnace. To obtain very high temperatures, as for melting metals, a furnace may be formed of the best non-heat conducting material and shaped internally to correspond to the crucible to be heated, the heating-conductors being coiled or applied round the inner surface of the furnace and passed out through the sides or bottom. The furnace has a cover, and the heat is economized in its development as the largest part of it is utilized, there being no constant draught through as in other furnaces. The heating-conductor should be of less resistance at the points of exit from the furnace, and is in metallic connection with conducting-wires. The furnace may be modified and used for roasting meat and the like.

To vary the supply of light or heat, the electric current may be regulated by joining up in the circuit an instrument which is provided with a hollow glass or like cylinder, partly filled with a liquid such as mercury, and containing an adjustable tapered or pointed rod as of copper or silver, the flow of the current being regulated by adjusting the height of the rod so as to increase or diminish the resistance.

The invention further relates to electric lighting.

A.D. 1878 . . . . . . No. 4043*.

Disclaimer and Memorandum of Alteration to the Specification of the preceding invention, filed January 10, A.D. 1882, by The Anglo American Brush Electric Light Corporation, Limited, the assignees, whereby they disclaimed the portion of the Specification to which the last paragraph of the foregoing Abridgment relates.

[*Specification printed*, 6*d*. *Drawing*.]

[*Disclaimer*, 4*d*. *No Drawings*.]

A.D. 1878, October 12.—No. 4050.

COULSON, MATTHEW.—Crushing, pulverizing, and disintegrating ores etc.

In the framing or standards of the machine, one or more

case-hardened, cylindrical, and either corrugated, fluted, or plain rollers are placed in fixed or adjustable bearings. Beneath the rollers there are one or more concave plates together with a regulator and tongue, which are fitted on a spindle and work as a hinged joint. The upper surfaces of the plates are plain, fluted, serrated, or otherwise figured, the wearing-parts being made in case-hardened segments. The regulator is adjusted by a short arm or lever placed outside the framing. The rollers may work either vertically or horizontally within the concave plates. To crush the ore to a given size, the rollers are adjusted and the plates are provided with wedges, which are made sectional and tapered, and are so adjusted by screws with or without springs or their equivalents as to set up the plates rigid and at any desired distance apart, while the wedges will break and give way in case of undue strain. The rollers are connected together and driven by gearing. A drawing shows two rollers with a concave plate beneath each. The ore is run in through a hopper to the top of the rollers, and in passing through is crushed by the rollers to a small size, so that it can be forced by the action of the rollers in between the rollers and plates, and thereby pulverized to any required fineness.

[*Printed*, 6*d*. *Drawings*.]

A.D. 1878, October 14.—No. 4063.

THOMAS, SIDNEY GILCHRIST.—Production of refractory bricks.

The inventor refers to his prior Specifications Nos. 289, 908, and 3975, A.D. 1878.

In producing refractory basic linings for open-hearth steel furnaces and Bessemer converters, to diminish the amount of silica and alumina imparted to the slag by the wear of the lining, there may be used "local kinds of magnesian lime-" stone in which the silica and alumina together amount to " less than five per cent. though to more than two per cent. of " the whole." The lower percentage may be approached if 2 or 3 p.c. of oxide of iron be also present, and the latter may even reach 5 p.c. in particular cases. Limestone, low in magnesia, or even chalk forms an inferior substitute. Mixtures of a nearly pure magnesian limestone with from 3 to 5 p.c. of oxide of iron, or 3 or 4 of clay, may be also used.

A very finely-ground and regular mixture or mass of the material employed is moistened and formed, preferably under great pressure, into bricks or blocks, which, after drying, are gradually heated and at length fired for many hours at a very intense white heat to produce a compact, hard, dense, shrunk structure. A kiln fired by a regenerative gas furnace will conveniently produce the intense heat required. It should have a down draught, with flue holes evenly distributed over its bottom. It may be lined with basic lime or best silica bricks, and its bottom be formed of lime bricks. The cooling must be very gradual, and access of cold air be avoided. A basic cement for the bricks may be formed by grinding some of them and mixing with a little of solution of silicate of soda.

[*Printed*, 4*d*. *No Drawings*.]

A.D. 1878, October 15.—No. 4097.

HACKNEY, William.—Regenerative gas furnaces.

According to this invention, which is applicable to melting and heating furnaces, a flame is obtained commencing only in the working chamber and directed downwards on to the matters to be heated, by introducing the gas into the chamber in one or more horizontal or inclined streams and by directing the air downwards upon it in vertical or more steeply-inclined streams Each air-inlet port may be wider than the corresponding gas port, so that the air may lap round and partly mix with the gas, (but this is not claimed); or the gas ports may be wider than the air ports ; or both may be of the same width, if the air ports are sufficiently above the gas ports for the air to spread before striking the gas. Or the air (or gas) may be admitted through a transverse slit. Again, if the gas ports are high, narrow, and close together, the air may be directed between them instead of vertically above the centre of each; or the arrangement may be otherwise modified, the gas sometimes lapping partly round the air.

Thus, the flame is directed away from the roof of the furnace (and also from its sides, by making the ports narrower than the chamber or converging towards its centre), thereby checking waste of fuel and injury to the brickwork.

[*Printed*, 6*d*. *Drawings*.]

A.D. 1878, October 17.—No. 4118.

SCOTT, William.—(*Provisional protection only.*)—Manufacture of nickel.

To obtain pure nickel sheets (instead of cast plates), cast nickel as prepared from the ore may be fused in a crucible containing manganese oxide mixed with powdered charcoal at the bottom, on which the metal is placed and covered with powdered charcoal. The fusion is continued for some time "to enable the manganese and the oxygen to react upon the "nickel," and afterwards the liquid metal may be poured into ingots as usual, which may be then worked under the hammer, rolled, or drawn into wire.

Another agent for rendering nickel malleable is tungsten oxide mixed with charcoal like manganese oxide.

[*Printed*, 2*d*. *No Drawings.*]

A.D. 1878, October 21.—No. 4195.

BARFF, Frederick Settle.—(*Letters Patent void for want of final Specification.*)—Protection of iron and steel surfaces.

As an improvement upon the inventor's prior Specification No. 862, A.D. 1876, a protective coating or film of oxide or oxides of iron may be formed upon the surface of objects composed of iron or steel by submitting them to the action of superheated steam.

[*Printed*, 2*d*. *No Drawings.*]

A.D. 1878, October 22.—No. 4217.

WILKINSON, Alexander.—Coating metals.

The surface is coated with a plastic preparation consisting of earthenware or china clay, nitrate of bismuth, nitrate of silver, mercury, and blue copperas. It is then fired, and the design transferred to it from suitably-printed paper pressed thereon. When the paper has been washed off the article is again fired.

[*Printed*, 4*d*. *No Drawings.*]

A.D. 1878, October 24.—No. 4275.

GJERS, John.—Refractory lining.

A lining, applicable to Bessemer converters, might consist of crushed ilmenite or titanic iron ore, mixed with lime and water

sufficient to produce a binding-substance which will set. The lining may be applied in the form of bricks, or by pugging and ramming.

[*Printed*, 4*d*. *No Drawings*.]

A.D. 1878, October 25.—No. 4286.

JOHNS, JOHN HENTUN.—Pickling and washing metal plates; coating and cleaning plates.

Steam or sulphuric acid vapour is supplied by a pipe to an inclined vessel through the top of which the plates are introduced. The plates are supported by guides and two levers, which are held in position by a catch; by liberating the catch, the plates descend into the washing-vat.

The plates pass through a tubular grease pot provided with two guides on each side, by which the plates are crossed alternately, the bottom of one plate crossing and resting upon the top edge of the next plate. The plates next pass through rollers which are mounted on a swivel, so as to cross the plates alternately in the guides of the bath. The feeding-end of the bath is surrounded by a steam, air, or water jacket for cooling the grease, and a flue passing through the metal at this end prevents the latter becoming chilled. The plates are withdrawn by rollers, and pass between the equalizers, which are chilled on the surface, after which they pass between a revolving steel brush and smooth roller to other rollers. The two sets of rollers, the planishers, etc. are supported between two frames hinged to a bar enclosed in the enlarged end of the bath. The rollers may be of glass, and the pressure between the planishers is adjusted by a screw etc. and indicated by a plate. The delivery end of the bath has a steam or water jacket, and the plates are next conducted by an endless band provided with projections to the cleaning-apparatus, being cooled during transit by air jets.

The plates are fed into a mouthpiece, and then pass between planishers (preferably made of india-rubber) to rollers, which feed them between horizontal brushes. The planishers are pressed together by a spring, and cleaning-material, such as bran etc., is fed by the hopper. The brushes revolve in opposite directions, and a current of cold air is maintained between them.

A.D. 1878. . . . . . . No. 4286*.

Disclaimer and Memorandum of Alteration to the Specification of the preceding invention, filed January 24, A.D. 1885, by Charles Stuart.

[*Specification printed*, 6*d*. *Drawing*.]

[*Disclaimer*, 6*d*. *Drawing*.]

A.D. 1878, October 25.—No. 4296.

BANTON, GEORGE WILLIAM.—(*Provisional protection only*.)—Manufacture of crucibles etc.

After referring to the use of a mixture of 3 parts by weight of plumbago to 1 of silica for dusting on to sand moulds to give a finish to metal castings, it is stated that "in making crucibles "80 per cent. of the above mineral will greatly diminish their "cost and increase their refractory power and durability." The same percentage is to be used for steel converters.

[*Printed*, 2*d*. *No Drawings*.]

A.D. 1878, October 29.—No. 4343.

WATERFIELD, WILLIAM HENRY.—(*Provisional protection only*.)—Furnaces.

In constructing and repairing the bridges, back walls, sides, jambs, necks, and flues of puddling, mill, and other furnaces, to increase their resistance to heat, the inventor employs Gornal freestone in blocks, or ground and mixed with Gornal silica and Gornal sand and formed into bricks.

[*Printed*, 2*d*. *No Drawings*.]

A.D. 1878, October 29.—No. 4362.

LAKE, WILLIAM ROBERT.—(*A communication from James Cosmo Newbery, John Lister Morley, and Barry Cleveland*.)—Collecting the solidifiable portions of metallurgical and other fumes.

To collect the solidifiable portions, such as oxide of antimony, arsenic, bismuth, lead, or zinc, from the permanently-gaseous, such as sulphurous and carbonic acids, the fumes are directed with great velocity against discs or other resisting-surfaces or through a filter, or these agencies may be combined. The

current of fumes is preferably concentrated so as to pass through a narrow opening or flue and then against a metallic disc, the operation being continued by the use of a series of flues and discs, on which, if the velocity of the current be great enough, most of the solids will impinge and then fall into receptacles beneath. The current is finally directed against a web of permeable material, through which the permanent gases filter, while the remaining solids are retained. This filter may be of metallic gauze, protected from the action of the fumes by a coating of a solid oxide. Asbestos or asbestos cloth may reduce the mesh of the gauze to any requisite fineness, or wool or vegetable fibre may be used when the fumes are cool. The use of an artificial draught is contemplated.

[*Printed*, 4*d*. *Drawing*.]

A.D. 1878, October 30.—No. 4370.

HOLLWAY, John.—Metallurgical apparatus.

The vessel described below may be used for the purposes of the inventor's prior Specification No. 1131, A.D. 1878. "The protosulphide would be run into the vessel and, after "oxidation, the resulting slag would be allowed to separate" and be withdrawn. More protosulphide would be then introduced and the oxidation continued. Sufficient "con-"centrated regulus having been produced, oxidation could be "completed in the shallow hearth."

A Bessemer converter (for making steel) may be so modified that "the vessel shall have two tuyere hearths, which can "alternately be brought underneath the metal by partial "revolutions of the vessel;" the latter assuming four principal positions. According to the description and drawings, one position is suitable for allowing slag to separate; in two other positions the metal lies on one or other of the tuyère hearths, the hearth, on which for the time being it is not lying, being above it and available for introducing sulphuretted hydrogen to produce free sulphur by decomposing the sulphurous acid evolved from the protosulphide under oxidation; while in the fourth position both tuyère hearths would be above the surface of the molten charge.

[*Printed*, 8*d*. *Drawings*.]

A D. 1878, October 30.—No. 4381.

WIRTH, Frank.—(*A communication from Hermann Escherich.*) —Gas kilns.

The kiln, in which ores may be roasted, " consists of a system " of tunnel canals, connected with and running into each other," and either round, oblong, square, or of other shape. There are removable doors or slides. " Around the kiln is placed a canal " which can be subdivided by bell caps or slides " into several divisions ; " each of which is alternately connected with the " chimney or gas generator." Each division of the chief canal is " connected by several bell caps to several subdivisional canals " or pipes, which lead to the several compartments of the kiln " and either terminate in pipes or holes in the floor. The pipes " are placed vertically to the floor, and are provided with holes " variously arranged. The pipes have sliding lids. The pipes, holes, and canals serve to introduce the gas and also to carry off the smoke, " which can be effected without any relaxation in " the working as the two operations take place in separate " compartments and are quite distinct." Each branch canal has a bell valve, slide, or the like, for regulating the passage of the gas and smoke. The air for combustion passes through the already burnt materials, and so mingles with the gas in a heated state to produce a rapid combustion. The products of combustion pass between the materials ready to be burnt, until they have lost their heat. " The fire moves as in a circular kiln always " forwards," taking from 4 to 24 days to go round the kiln. A canal carries cold fresh air to the gas generators, and metal separators " take up the dust and gases caused by slacking the " generator fires." Sight holes are provided. Tar deposited by the gases in the canal may be received in pots. The claims include the pipes " serving to introduce and scatter the gas, the " combustion chambers serving to draw off the smoke and " products of combustion and to draw off hot air and introduce " cold air ;" a change apparatus and canal in the top of the kiln for use in place of the chief canal to carry off the products of combustion, so that the latter can be used solely for introducing gas ; an arrangement for conducting the flame from one half or side of the kiln to the other ; and cross canals, provided with bell traps, so that any part of the kiln may remain in work without the remainder.

[*Printed*, 6*d*. *Drawings.*]

A.D. 1878, November 1.—No. 4411.

SALWEY, EDWARD RICHARD.—Furnace bricks or blocks, retorts, crucibles, and other fire-resisting articles.

Flints (including flint rock or pebbles) are washed or otherwise treated to remove any adhering alumina or clay, next calcined, and then reduced to fine powder, which is thoroughly mixed with about 2 p.c. of white or chalk lime contained in water as milk of lime. The resulting mortar may be formed into bricks by tempering, moulding, drying, and burning in kilns. These highly-silicious firebricks are of great strength and durability, will resist the highest temperature, and do not expand or contract under the action of fire. The bricks may be also made from the pulverized flint moistened with pure water, without using lime or other material. The pulverized flint, with or without the addition of lime, may be used as a cement for setting the bricks etc., or for furnace linings. Other fire-resisting articles may be made from the same materials.

In making building bricks, blue lias or greystone lime is used instead of chalk or white lime, that they may better withstand the action of the weather.

[*Printed*, 4*d*. *No Drawings*.]

A.D. 1878, November 2.—No. 4443.

VON NAWROCKI, GERARD WENZESLAUS.—(*Thorn, William.*) —Coating sheets of iron and copper with lead.

Apparatus employed in the manufacture of alum, of certain acids, and of other chemical substances, which is ordinarily made of lead, is under this invention constructed of iron or copper sheets, first tinned, and then coated with lead. The iron or copper sheets are cleansed with dilute hydrochloric acid containing a little zinc chloride, and after being well tinned on one side, are set horizontal with a sand edge or wall. They are heated to a specified temperature, and molten lead is run on them to the desired thickness, sometimes with an overlapping edge. The sheets are afterwards hammered and rolled, when they may be worked up in any desired way. Very strong and thick apparatus of iron or copper, may be coated with lead by use of an inserted mould or core, between which and the inner metal surfaces the molten lead is poured.

[*Printed*, 4*d*. *No Drawings*.]

A.D. 1878, November 9.—No. 4549.

HOLLWAY, John.—Separation of metalliferous substances from sulphides.

By blowing air through and upon molten sulphides, the inventor obtains " in separate groups, as metals, or in the form " of oxides, sulphides, or as slag, the metals originally contained " in the sulphides." The sulphides are thus also utilized as fuel, and other metalliferous or slag-producing materials may be treated with them. A vessel or furnace is preferred with tuyères so arranged that, while air is driven upward through the molten sulphides, it can also be driven downward into the vessel, so as to moderate the temperature and control the volatilization of metals. The mouth of the vessel is so placed that the substances carried over by the vapours can be collected.

Galena may be treated in a basic-lined vessel, some molten sulphide of lead being first introduced and oxidized to generate heat for melting more galena to be thrown in at intervals. The oxide of lead obtained reacts on the sulphide of lead, metallic lead being produced, containing the gold and silver present in the substances treated. When treating ores containing various metals, some of which are to be volatilized, the inventor employs a higher and gradually-increasing temperature by increasing the upward blast of air and decreasing the downward blast.

[*Printed*, 4*d*. *No Drawings.*]

A.D. 1878, November 12.—No. 4576.

EDWARDS, Edmund.—Separating substances of different specific gravities.

Referring to his prior Specification No. 1861, A.D. 1874, the inventor now uses the following apparatus for the continuous removal of the several portions, into which ores etc. may be separated upon a perforated screen by pulsations of water.

A screen or sieve, circular in plan and preferably flat, is placed horizontally in a circular vessel of water, and the ore is fed upon it through a central hopper, beneath which is a distributing-plate. Water may be also supplied through the hopper. The screen rests upon supports somewhat below the upper edge of the vessel, and there is fixed centrally a vertical cylinder, the upper edge of which rises above that of the said vessel, its lower end being closed or resting upon a plate which

occupies the centre of the screen. Outside this inner cylinder there is an outer cylinder of greater diameter, which rises as high as the inner one, but its lower edge does not reach down to the screen or central plate, an annular and sometimes adjustable space being left between them all round. Outside the vessel containing the screen there is an annular trough, the bottom of which is somewhat below the outer edge of the vessel, while its outer side rises at least as high as this edge. Upon a continuous circular flat flange or angle iron outside the trough there run friction-wheels, carried by the outer ends of radial arms or bars, which unite at the centre of the machine and fit upon a central vertical shaft. The latter passes down through the said plate, which may rest upon a collar on the shaft. The vessel is preferably conical below the screen, tapering downwards till it ends in a chamber, into which the fine particles passing through the screen fall, and at the bottom of which the lower end of the said shaft revolves in a step or bearing. Below the screen the vessel communicates with a vertical cylinder, wherein a plunger or one or more flexible diaphragms can work rapidly up and down, so that the water is forced up and down through the screen in pulsations. To the radial arms, which slowly revolve, there are attached adjustable scrapers, arranged spirally, and so that their lower edges dip sufficiently into the material on the screen: and when the space above the screen is full of material separated by the pulsating washing process, the scrapers force the upper and lighter part of it (consisting of waste or poor ore) toward the outer edge of the vessel and over it into the annular trough. A scraper on the revolving arms scrapes round the material in the trough and discharges it through an opening, made at one part of the bottom and connected to a receiver. A scraper, which is attached by bars to one or more of the revolving arms, is so adjusted that its lower edge passes round at a short distance above the screen. This scraper, which has but little depth, is of such a spiral shape that it collects the heavier parts of the ore lying upon the screen and moves them centrally, so that they pass under the lower edge of the said outer cylinder and partly fill the annular space between it and the inner one. A hinged scraper on one revolving arm is drawn round in this space and scrapes up the heavy material accumulating there. At one point the space contains an inclined plane, up which

this material is drawn and is discharged through an opening at the top above the level of the water, while the scraper travels down another plane and then collects fresh material. From the said opening a passage leads laterally into the inner cylinder, and passes through the central plate and diagonally downward to a side opening at the lower part of the machine. Thus the heavy material is continuously collected and discharged without stoppage of the machine or loss of water. By means of an endless chain of buckets or scrapers the fine particles, which have passed through the screen, are drawn up a passage of corresponding section and are discharged into a shoot at a sufficient height, while the empty scrapers return through a like passage. Endless metallic chains (provided with pulleys etc.), preferably drive the scrapers, each chain being composed of parallel metallic links jointed together, while the scrapers are made of metallic plates, fitting the passages and having their ends riveted or bolted to the links. The links travel in or between longitudinal grooves or guides on the interior of the passages, so that the plates are kept at right angles to the line of the chains. The lower part of the said shaft carries an agitator with radial or spiral blades, which force the fine particles into an opening in the side of the chamber whence the scrapers remove them.

The arrangements may be modified; thus, the heavy material may be carried towards the circumference of the vessel and pass through a passage extending all round beneath the said annular trough into an outer annular trough, whence it is removed by a scraper with the aid of inclined planes. In this case the discharge spout for the lighter material passes from the inner annular trough laterally through the outer one at the part where the inclined planes are placed. Again, the heavy material may pass under the edge of the outer cylinder and over the upper edge of the inner one, the height of which may be made adjustable. Sometimes the radial arms may be connected to the vertical shaft by a movable clutch or coupling, so that the shaft and agitator are only set in motion when needed; motion being communicated to the said arms from another shaft (carrying an eccentric, which drives the plunger) by means of toothed wheels: or other driving-mechanism may be used.

[*Printed*, 8*d*. *Drawings*.]

A.D. 1878, November 12.—No. 4582.

MASSEY, Stephen.—Steam hammers or hammers actuated by other fluids.

Consists in an arrangement of hammer for breaking, or crushing stones, ores, or other such substances. The piston-rod is ordinarily placed at an angle, say about 30 degrees to the horizon, but it may be placed horizontally, vertically, or at any angle, its end being prolonged through the back or top cover of the cylinder and the valve gear actuated from that end away from the dust and grit of the material. The hammer strikes into a box or chamber into which the material falls from a hopper or opening and when broken passes out through another opening therein, the size or form thereof being fixed or variable according to the effect to be produced. Special valve gear may be used.

[*Printed*, 6*d*. *Drawing*.]

A.D. 1878, November 13.—No. 4612.

CONWAY, Charles.—(*Provisional protection only.*)—Preparing iron, steel, or other metal sheets and wire, preparatory to their being coated with tin, lead, or zinc.

The iron, steel, etc. in the form of sheet or wire is passed by rollers through a bath containing vegetable or mineral tar or hydrocarbons, before annealing. The materials may also be applied by hand.

[*Printed*, 2*d*. *No Drawings.*]

A.D. 1878, November 18.—No. 4681.

SMITH, Thomas James.—(*A communication from Andreas Mechwart.*)—(*Letters Patent void for want of final Specification.*) —Breaking and pulverizing machinery.

Reference is made to the prior Specification No. 563, A.D. 1878, which relates to "rotary antifriction pressure rings" used in machinery for granulating and crushing grain and seeds, " these rings embracing the outer axles of the roller mill and " revolving with them, thus annihilating by their tension the " pressure exerted on the axles of the rollers, and thereby also " the friction in the bearings."

Similar rings may be applied to mills or machinery for breaking, pulverizing, etc. The "rings revolve on and with the "coupling boxes fixed on the end of the axles coupling with "the next set of rollers." The "tension is obtained by means "of levers, pivoted at one end to the frame or foundation of "the mill" and provided with rollers bearing on the inner periphery of the ring. "The opposite end of each lever may "be provided with a toothed quadrant taken into by a worm, "the shaft of which" has a hand-wheel to regulate the desired pressure.

[*Printed*, 2*d*. *No Drawings.*]

A.D. 1878, November 22.—No. 4755.

COBLEY, Thomas Henry.—Treatment of copper ores.

The invention mainly relates to treatment for electrodeposition, but various operations are described.

Sulphides like cupreous pyrites are roasted to eliminate extraneous sulphur and form soluble sulphate, the crushed pyrites being preferably exposed in a closed furnace (with a chamber for collecting sulphur fumes) to a temperature proper for converting it into protosulphide, which is roasted into sulphate on the hearth of an oxidizer. Some powdered pyrites or sulphur may be thrown in to complete sulphatization. Afterwards the mass is lixiviated by steam or steam and water or liquor from the depositing-tanks, and dilute sulphuric acid or persulphate may be first used to take up oxide formed during the roasting. The solutions may be strengthened by repeated action on fresh roasted ore. Impurities like iron are removed from the solutions, when cold, by limestone, chalk, magnesite, or dolomite. Or the solutions, containing salts of copper, iron, alumina, etc., may be concentrated and crystallized, the crystallized salts being removed and the mother liquors used for attacking fresh ore. Or the solutions may be evaporated to a pasty state by passing over or through them the hot sulphurous fumes from the roasting, the fumes being thus cooled. These fumes may be converted into sulphuric acid and water by condensing them in acidulated water, or such a solution as of sulphate of soda or alumina, through which an electric current is passed until much acid is present. Afterwards the sulphur subsides, and the decanted acid liquor may be concentrated or

used at once in dissolving ore. The said crystals or pasty masses are calcined below redness to render the iron compounds insoluble, without decomposing the sulphate of copper, which is then dissolved. The electrodeposition of copper from the solutions is effected according to a method described.

For the mechanical separation of the gangue and concentration of the copper, ores containing carbonates of copper may be gently roasted to drive off the carbonic acid, and then triturated with water in a receptacle wherein stone blocks are carried round by revolving arms, the fine particles being floated off and collected in vats. The enriched slimes thus obtained may be farther dressed and smelted as usual, or be dissolved to obtain copper by electrodeposition. Or the carbonate or concentrated oxide may be converted into sulphate (for subsequent lixiviation and treatment), by roasting with the crude sulphur from the electrical treatment of the sulphurous fumes or the condensed fumes of the roasting or with an admixture of powdered pyrites.

[*Printed*, 4*d*. *No Drawings*.]

A.D. 1878, November 22.—No. 4767.

WHITEHOUSE, Daniel.—(*Provisional protection only*.)—Manufacture of tin, terne, and similar plates.

The pickling-trough or tinning-pot, as the case may be, is provided with four longitudinal guides which extend from one end of the pot to the other; these are curved upwards at both ends, and are grooved longitudinally throughout their length. Two of these guides are placed parallel near the bottom of the pot, the other two are placed parallel a little above them, the distances being so adjusted that the plate may rest in an inclined position in one of the lower, and the opposite upper guide. A plate is introduced in this way and is pushed as far into the liquid as possible. Another plate is then inserted into the other pair of guides, and is pushed forward, thereby pushing the first plate before it. Other plates are then introduced alternately in the positions of the first and second plate, each as it is introduced pushing the others forward. As each plate reaches the other end of the pot, it is removed, and is ready for the next operation. The guides are preferably of brass or copper for pickling-troughs, and of iron for tinning-pots. They may be provided with rollers

if necessary ; for large plates a central guide may be used, and in some cases two or more tiers of guides may be used. It is preferred to insert in the pickling-trough and tinning-pot an inner vessel which carries the guides ; this renders a smaller body of liquid necessary, and allows of easy examination and repair of the guides.

To maintain the grease in which the finishing-rolls work at the required temperature, pipes are passed through the grease, conveying water.

The apparatus for cleaning the plates consists of a series of rollers, some of which move the plate forward and others rub and clean the same. First there are two rollers which work close together so as to move the plate forward, and then a larger pair of rollers rotating in an opposite direction and placed in a box or case containing bran or other material for cleaning the plate. The same material is supplied from the hopper at the top of the box. Beyond the box are four pairs of rollers alternately similar to the first and second pair respectively, the last pair not being supplied with bran &c. The smaller rollers are preferably covered with india-rubber and the larger ones with sheepskin. Guides are provided for the plates, and these guides are fitted with india-rubber rollers. The rollers are worked by any suitable gearing, and the pressure exerted by the large rollers is determined by springs.

[*Printed*, 4*d*. *No Drawings*.]

A.D. 1878, November 23.—No. 4780.

RILEY, Edward.—Refractory bricks, linings, crucibles, and other articles.

Burnt lime, preferably magnesian lime, is ground with from 5 to 15 *p.c.* of crude petroleum oil, coal oil, rosin oil, or like liquid, which, without hydrating the lime, will moisten and render it plastic or cohesive. Sometimes a little coke may be ground with the lime. Some oxide of iron, burnt clay, silica, alumina, magnesia, and the like may be added to render the material when burnt more coherent. After moulding into bricks or other forms, the same may be heated in close vessels to distil off the oil for use again. Afterwards the bricks may be burnt in a kiln with a lime or limestone bottom. A pressure of a ton to the square inch is desirable in moulding when a strong brick is

wanted. For lining a furnace or converter, the bricks, burnt or unburnt, may be built into it, or the plastic lime may be rammed round a mould or core ; also a furnace may be provided with a lime or basic hearth. A fire is then made, and iron scale or oxide may be thrown in to obtain a glazed surface. Great shrinkage in the bricks is avoided. Crucibles and other metallurgical articles may be rammed or pressed into moulds and burnt like bricks.

[*Printed*, 4*d*. *No Drawings.*]

A.D. 1878, November 23.—No. 4781.

ELLIS, JOHN.—(*Provisional protection only.*)—Furnaces.

The invention, which is applicable to furnaces for heating and melting brass, gold, silver, and other metals, is described with reference to a bottle glass furnace, increased efficiency of fuel being obtained and loss of metal from the fracture of a crucible or pot obviated. The furnace may have a D shape, the front of the D being the front of the furnace. At about the centre of the D is constructed a firegrate, around and above which is formed a siege for the pots ; the same are beneath the arched or reverberatory roof, terminating at the boundary wall of the furnace a little above the edges of the pots where the charging and collecting apertures are formed. Air under pressure enters beneath, through, and above the firebars, in the latter case being injected to converge towards the centre of the fire. Thus a high temperature is obtained, and the flame dips into the pots and impinges upon their contents. An inclined trough conducts away the metal if a pot fails. Parts of the furnace may be protected by water-boshes. The heated gases are conducted away from the men at the charging and collecting apertures by neighbouring flues. Again, the furnace may be of a square, oval, or V shape, the vertex of the V forming the front of the furnace. When treating large quantities, the products from a double furnace may be led into a common receiver.

[*Printed*, 2*d*. *No Drawings.*]

A.D. 1878, November 27.—No. 4832.

LECHESNE, OCTAVE.—Alloys.

Malleable and workable alloys, for use instead of silver and also to replace nickel-plated articles, may be produced.

An alloy containing cadmium may be made by melting in a crucible 650 parts of copper, 275 of nickel, 5 of tin, 50 of cadmium, and 20 of zinc, the proportions of the latter three metals being variable according to the homogeneity, hardness, whiteness, etc. desired. The flux used for introducing the cadmium is "tartrate acid of potash carbonized," adding charcoal powder to check oxidation of the copper, volatilization of zinc, and sudden consequent cooling, thus maintaining the heat during the mixing.

Another alloy may be made by melting together in the following order about 650 parts of copper, 0·5 of lead, 175 of nickel, 0·5 of tin, 1 of cadmium, and 173 of zinc.

Dispensing with cadmium, a substitute for German silver may be made with about 755 parts of copper, 0·05 up to 0·5 of lead, 155 of nickel, 0·5 of tin, and 90 of zinc. Another example of the use of a small proportion of lead is exhibited by 750 parts of copper, 0·05 up to 0·5 of lead, and 250 of nickel. The lead is first melted with the copper and is the cause of the intimate union of the copper and nickel, whereby superior alloys are obtained. Even a little lead in the alloys will thus produce a considerable effect: it may also be added after the nickel or other metals. The tin and zinc improve the alloys, for instance, as regards colour, comparative freedom from oxidation, facility of working, and cheapness.

[*Printed*, 4*d*. *No Drawings.*]

A.D. 1878, November 30.—No. 4886.

DAVIES, David.—(*Provisional protection only.*)—Coating iron plates with tin or other metals.

The plates are conveyed by a disc-wheel mounted above the bath, from the grease or flux pot at one end of the bath, through the latter, and delivered through adjustable guides direct into a grease pot, containing the finishing-rollers and washing-roller box at the other end of the bath. The disc-wheel is provided with self-acting fingers, which work in connection with apparatus on the grease or flux pots and automatically grip and release the plates. When desirable or preferable to the using of the disc-wheel for feeding the plates, a ring or rings may be used, of similar diameter to the wheel, but revolving with its bottom edge in or near the upper portion of the liquid bath.

Metallic oxides, scruff, etc. are removed by a washing-roller box, formed of one or more rollers or bars placed inside a hollow roller or box constructed to receive a central and surrounding rollers. Lateral motion may be given to the rollers or bars, or they may be used without the box, by fixing them in adjustable end bearings. The oxide of iron is removed preparatory to coating the plates, by using the vapour of sulphuric acid instead of the liquid.

[*Printed*, 2*d*. *No Drawings*.]

A.D. 1878, November 30.—No. 4896.

WILSON, JOHN GUY.—(*A communication from Valentin Neukirch.*)—Treating ores or alloys.

A solvent, which differs according to the nature of the metals to be dissolved, continually flows down from a reservoir through a pipe, stop-cock, and second pipe to the lower end of an angular ore chest, and rises therein with such a regulated velocity that the crushed ores or alloys are prevented from sinking, the reservoir and ore chest preferably having the form of an inverted cone or funnel. The chest has an overflow pipe, the mouth of which is turned downwards into the liquid contained in the chest sufficiently far to prevent any swimming particles from overflowing. The overflow is raised again to the reservoir by a pump or otherwise. The process of dissolving being finished, the stop-cock is turned to close the communication from the reservoir and to open one from a water basin to the ore chest. Other stop-cocks and pipes are provided and are so arranged that part of the water from the said basin may rise into the ore chest and part of it be discharged through a pipe, while part of the solution is drawn off for separating the metal from it. The undissolved residua being discharged out of the chest, the operation is repeated with fresh ore. The residua pass to a basin with a sand bottom, forming a filter to retain the residua, while the water runs through the filter and is raised to the said water basin for further use.

When a gas, such as chlorine, is used as a solvent, say, for gold, it is produced in the chest itself, into the lowest part of which two pipes discharge. One pipe conveys dissolved chloride of lime from one vessel and another pipe hydrochloric or other acid from another, the chloride of lime and acid meeting and

entering the lowest part of the chest. Thus chlorine gas is produced and acts upon the ore suspended in the water. The chest is hermetically closed to prevent the escape of the gas, and the hopper, which supplies the ore, must discharge into the chest below the level of the water. Escaping chlorine gas is conducted over layers of pulverized limestone. To control automatically the production of the gas when the pressure becomes excessive in the chest, a vessel, filled with water and covered with an " inevaporable " fluid, is established within the chest. The bottom of this vessel is connected to a vertical pipe of smaller diameter than the vessel, and this pipe passes through the cover of the chest to the outside, where it is provided with a float in connection with angular levers and cocks ; which latter are shown in a drawing as placed on the supply pipes, and are controlled by the rising and falling of the float and thus control the flow of chloride of lime and acid. A series of ore chests may be used in conjunction. One claim is for " the method of " separating the residuum from the dissolving solution by means " of a current of fluid."

[*Printed*, 6*d*. *Drawings*.]

A.D. 1878, December 5.—No. 4973.

ATWOOD, Levi Lincoln.—(*A communication from Aaron Blanchard Brown and Wendell Phillips Brown*.)—Covering or coating metal surfaces, chiefly in the manufacture of wire.

The wire, before galvanizing or coating, is treated first with a solution of alkaline phosphate, and then, after drying by being drawn through pads, with a solution of a caustic alkali. Sulphate-of-soda solution is also mentioned in the Provisional Specification.

[*Printed*, 4*d*. *No Drawings*.]

A.D. 1878, December 5.—No. 4982.

ATKINSON, Edward James.—Calcining.

Ores may be calcined by a blast of heated air, without becoming contaminated with products of combustion. The air is heated by a suitable stove or apparatus independent of the calcining-kiln, which is so constructed that the heated air passes in fine streams amongst the ore and becomes distributed through

the mass of it. The kiln has at or towards its base a central chamber, into which air heated to the required temperature is forced. On each side of this chamber is an elevated calcining-chamber with openings at the upper part for introducing the ore. Tubes pass through the walls between the central and calcining chambers and terminate within the external walls of the latter, so as to give support to the walls while forming conduits for the heated air. The tubes are open at their inner ends to the central chamber, from whence heated air passes along them and escapes through holes in the lower side of the tubes, and is thus distributed among the ore in the calcining chambers. Thus the ore is calcined at the lower part of the kiln and is discharged through shoots or inclined passages below, provided with external doors. The ascending air partly dries and heats the ore at the upper part of the kiln preparatory to the descent of such ore to take the place of that calcined and drawn; whereupon fresh ore is supplied above so that the operation is continuous, all the heat being advantageously utilized.

There may be a calcining-chamber on one side only of the hot-air chamber, instead of on both sides, and the hot air chamber may be divided into compartments capable of being worked separately or in combination.

[*Printed*, 6*d*. *Drawing*.]

A.D. 1878, December 6.—No. 4996.

HODSON, WILLIAM.—(*Provisional protection only.*)—Washing clay and other materials.

Apparatus for washing clay, chalk, and other materials used in brick-making, whereby stones etc. are removed. The materials are placed in a cylindrical or other shaped chamber placed horizontally, and are saturated with water by means of arms or blades on a revolving shaft passing through the chamber. Arms etc. may also be fixed to the sides of the chamber. The materials are introduced through a hopper or feed hole in the upper part, and pass out with the water through an opening to a trough or channel, across which is placed a sliding grate or openwork screen to arrest matter not in a sufficiently-divided state. Openings fitted with suitable covers are provided for obtaining access to the chamber.

[*Printed*, 2*d*. *No Drawings*.]

A.D. 1878, December 7.—No. 5016.

HADDAN, HERBERT JOHN.—(*A communication from Joseph de Baxeres de Torres and Alexis Drouin.*)—Treating ores containing silver and copper.

Pulverized ores containing silver (including sulphurets of silver) may be treated with a solution of marine salt acidulated by nitric, hydrochloric, sulphuric, or other suitable acid, whereby the silver is quickly transformed (even when cold) into chloride of silver which remains in solution, previous calcination not being requisite. The operation is hastened by adding a little binoxide of manganese to the ore. The same solution, when cold, quickly dissolves the copper in an oxidized ore. Should the ore contain sulphur, arsenic, or antimony, it is roasted to a dark red heat in a very oxidizing atmosphere and advantageously with the admixture of a very small proportion of binoxide of manganese. The silver and copper are preferably dissolved in casks, which have double bottoms perforated and covered with a cloth to serve as a filter, whereon the ore is placed, and where it is kept suspended in the acidulated saline liquor by a stirrer actuated by animal or steam power. The liquor afterwards passes from the lower part of the cask into other casks containing fresh ore, and when it contains all the metal capable of solution, the silver is precipitated by copper and the copper by iron. The precipitated metals are well washed, dried, and smelted, while a little acid is added to the residual liquor holding different salts of soda and iron, and it then serves afresh for dissolving silver and copper. The gangues are repeatedly washed in a solution of acidulated salt, and lastly in pure water. To hasten this washing and completely extract the silver, hot or else cold solvents for chloride of silver may be used, such as ammonia or hyposulphite of soda. " All alkaline " chlorides and earthy or metallic alkalines soluble in a solution " of acidulated water" may be used instead of marine salt (chloride of sodium).

From pulverized complex sulphurous ores in which silver predominates, that metal is first extracted by the said liquor, copper being scarcely attacked owing to the presence of the sulphur. After washing, the residue is calcined and treated afresh with the liquor, which, when cold, quickly dissolves the copper. When copper predominates, the process begins by

volatilizing the sulphur, oxidizing the ore by calcination, then treating it with the liquor which simultaneously dissolves the copper and chloridizes the silver, and recovering the latter partly from the solution by precipitation and totally by washings as above stated. Any known solvent for chloride of silver either hot or cold may be used for the solution of the chloride obtained as described. Slag may be treated as well as the most complex ores.

[*Printed*, 4*d*. *No Drawings*.]

A.D. 1878, December 9.—No. 5028.

ABEL, Charles Denton.—(*A communication from Pierre Dronier*.)—Malleable bronzes containing mercury.

The alloys of copper and tin called bronzes may be rendered perfectly ductile or malleable by admixture therewith of a small proportion (from $\frac{1}{2}$ to 2 *p.c.*) of mercury, which "does not "appear actually to enter into the composition of the alloy, "its effect being rather a mechanical than a chemical one." The mercury may be mixed with the molten tin, and the mixture then added to the melted copper; or the mixing may be effected in other ways. The mercury also renders the alloy harder, more elastic and sonorous, and less oxidizable.

Mercury may be likewise added to such bronzes as contain other metals with copper and tin, to render them more malleable.

[*Printed*, 4*d*. *No Drawings*.]

A.D. 1878, December 11.—No. 5066.

KESSELER, Carl.—(*A communication from Albert Wegelin, Ernst Hübner, and Emil Pollacsek*.)—Treatment of metallic oxides.

This invention is applied in the process of extracting metals, to which the subsequent Specification No. 2431, A.D. 1879, relates.

Metallic oxides, which may be formed by treating metals with steam, are to be dissolved in a solution of carbonate of ammonia. This solution is subjected to distillation by steam, during which the ammonia is recovered and the metal is precipitated in the distilling-apparatus as a sub-carbonate of the metal treated; but, if the solution contains metals in a form to be precipitated by other metals, this precipitation is effected

before the distillation, copper, for instance, being replaced by zinc, silver by copper, etc. The ammonia is supplied with fresh carbonic acid when needed. The dissolving-apparatus comprises a sheet-iron vessel, provided with a stirrer and with different openings and pipes for filling the vessel, discharging the residuum, taking samples of the liquid, discharging liquid, establishing communication with the top of a condenser, supplying water, and letting in carbonate of ammonia from the condenser, and also with a water gauge and with two filters, each having two filtering-layers for the liquid lying over the residuum and for that contained in the latter. The discharged liquid, still containing suspended impurities, is further purified in a cast-iron filtering-apparatus, which has on its cover an inlet valve for the decanted liquid, and laterally two valves, respectively over and under the filtering-medium, for conducting the liquid from the residuum of the dissolving-apparatus (if still turbid) through the filtering-apparatus. The latter also has a valve leading to an air exhauster to accelerate the filtration, and a discharge valve to the wrought-iron precipitating-apparatus. The latter has a stirrer and a wooden grate to receive the precipitating-substance, and it also has two manholes, an opening for discharging residua, a filter, inlet and outlet pipes for the liquid, a pipe for air communication with the dissolving-apparatus, and a water gauge with a cock. The solution, from which the metals have been precipitated, flows automatically to the distilling-apparatus, formed of wrought iron with bulged cover and conical bottom. There are also a stirrer, manhole, steam and ascension pipe, gas escape pipe, pipes for letting in the residuum and for air connection with the precipitating-apparatus, water inlet, pressure gauge with safety-valve, and water gauge. Here the carbonate of ammonia is distilled and the metallic salts are separated by the direct action of steam of five-atmospheres pressure. The gases developed pass into a rectifier or sheet-iron box containing two systems of pipes. These are surrounded by circulating-water which regulates the temperature of the gases. The latter, as they pass down, are freed by condensation from most of the accompanying steam, which runs into a receiver or automaton and is returned to the distilling-apparatus. The gases of carbonate of ammonia afterwards enter the condenser, which has a cooling-worm and a pipe connection for the outlet into the dissolving-apparatus.

Uncondensed gases go into supplementary condensers or Woolf's bottles, and the last remnant to a reservoir for sulphuric acid. Two complete systems of apparatus for separate or combined use provide for continuous working without loss.

[*Printed*, 6*d*. *Drawing*.]

A.D. 1878, December 14.—No. 5126.

GLASER, Friedrich Carl.—(*A communication from Theodor Fleitmann.*)—Preventing the formation of blowholes and crystalline structure in cast metals, and giving thereto a fibrous structure with greater ductility.

To effect these results, an addition of magnesium is to be made to other metals, when melted, "especially to nickel, " cobalt, iron, steel, copper, and to the alloys of this latter " with nickel, tin, and zinc." The magnesium may be introduced " through a small opening in the cover of the crucible " containing the molten metal after it has been cleared of all " dross, and the mixture of the same together" is effected by agitating the vessel.

[*Printed*, 4*d*. *No Drawings*.]

A.D. 1878, December 14.—No. 5127.

GLASER, Friedrich Carl.—(*A communication from Theodor Fleitmann.*)—Plating metals, more particularly iron, steel, copper, and the alloys of the latter, with nickel and cobalt.

The contact surfaces of the metal or core to be coated, and the nickel to be laid thereon, are by filing, rubbing, and cleaning worked so that contact at all points is effected. The surfaces are then sprinkled with a welding-substance such as borax ; the pieces are heated to the necessary welding heat, and united by hammering. The nickel or cobalt used may be manufactured in the manner described in Specification No. 5126, A.D. 1878.

[*Printed*, 2*d*. *No Drawings*.]

A.D. 1878, December 14.—No. 5130.

KNIGHT, William Henry Nunn.—(*Provisional protection only.*)—Cleaning and tinning metal plates.

A method of coating metal plates with grease and metal specially applicable to the manufacture of tin and terne plates.

Revolving or otherwise moving flat surfaces or rings, uncovered or covered with hard or soft material are used. These

are supplied with grease by means of hollow spindles or hoppers and the plates are passed between them. The plates are conveyed through grease and metal contained in a pot, then between moving or stationary brushes, and then through metal and through grease to the finishing-rolls. The required pressure is put on the finishing-rolls by spring balances attached to the ends of levers.

Machines with the before-mentioned flat surfaces or rings are also used as cleaning-machines, bran or pollards mixed with fullers' earth being used as the cleaning-material. The plates are placed in boxes containing fullers earth, working on axles before being passed to the machine.

[*Printed*, 2*d*. *No Drawings*.]

A.D. 1878, December 20.—No. 5217.

CROSLAND, EDWARD.—Calcining kilns for ores etc.

As improvements in the class of kilns to which the prior Specifications of C. W. Siemens, No. 2395, A.D. 1867, and of C. W. Siemens and A. Stein, No. 3457, A.D. 1874, relate, the present inventor provides a gas producer "separated from the kiln by " only a comparatively thin partition or wall, through openings " in which the gas flows at or near the temperature at which it " is made." The gas producer is placed at some height from the bottom, and "as much under the charge as possible to ensure " the flame passing through every portion of the material under " treatment: thus the kiln may be symmetrically vertical, it " may have an inclining annular space above the gas-ports, or " the whole may lean over the producer." Air enters by ports or the discharging-door near the base of the kiln, and, in rising, cools the descending calcined material and becomes itself highly heated by the time it reaches the belt of gas-ports. An intense heat is then produced by the combustion of the already hot gas, the raw materials introduced at the top also becoming heated as they descend to this part of the kiln, where the calcination is finished. The lower part of the upper portion of the shaft or kiln, just above the belt of gas-ports, is preferably made sloping, to cause the descending materials to "roll and change place" and the ascending flame to cross the kiln and distribute the heat. A natural or forced draught may be used.

[*Printed*, 6*d*. *Drawing*.]

A.D. 1878, December 21.—No. 5239.

WILSON, Henry Joseph, WILSON, John Wycliffe, and FRENCH, Andrew.—Treating air, gases, liquids, and furnace chimney products, and separating component parts thereof.

Metallic fumes, such as are evolved from furnaces in smelting or refining gold, silver, lead, or zinc, may be separated from the furnace gases etc. and saved, the gases being also purified. A wooden vessel or casing, rectangular at its upper part but inclined inwards like an inverted pyramid at the lower parts of its sides, contains at each end an internal vertical partition, beneath which the gases etc., admitted to the spaces between these partitions and the ends of the vessel, pass in thin broad streams or films into the interior of the vessel. The vessel contains water or other liquid, and the gases now spread under a horizontal partition, fixed in the interior of the vessel, and containing slots with serrated flanges along the edges of the slots. The gases rise through the slots, and by the help of the serrated flanges are divided into numerous small streams uniformly distributed over the area above the horizontal partition. This area may contain three screens of wire gauze, through which the gases ascend, carrying some of the water with them. An intimate and complete contact or intermingling of the gases etc., (which become minutely subdivided), and the water is thus effected, so that the fumes and other suspended or soluble constituents of the gases are effectively washed out or are retained by the water. The washed gases may pass off by an outlet pipe. Separate unimpeded central passages are provided for the re-descent of the rising water, which carries with it the fumes or suspended matters, and the latter subside to the bottom of the vessel, whence they can be removed by a discharge valve, sludge pump, or otherwise. By placing the different screens at intervals of from 1 to 2 inches above one another and above the slotted partition and beneath the water level, only about 8-inches head of water will have to be overcome by the gases and a moderate forcing or exhausting power (by fan, blower, or otherwise) will suffice, and this power may be diminished by reducing the intervals in question. Sometimes a second vessel is employed, but it is preferred to use extra screens and a greater depth of water. The interstices

of the gauze should not be wider than one-fifth of an inch, but should be large enough not to keep back the particles of fume. The vessel may have a removable cover to provide for cleaning etc., and a glass gauge to indicate the height of the water. The slotted partition may be replaced by horizontal pipes, leading from the spaces beyond the vertical partitions, and preferably of a triangular section with a horizontal side at the top. In this case the gases are divided into streams on entering the pipes, and are further divided in passing through perforations in the said horizontal sides and the top parts of the other sides of the pipes. Again, the vertical partitions may be also dispensed with; and the pipes may pass through the ends of the vessel and communicate with larger horizontal pipes at right angles to them. The pipes have end covers to facilitate cleaning. To check corrosion, the screens may be made of copper, silver, gold, silvered or gilded copper, platinum, platinized iron or copper, aluminium, aluminium bronze, or phosphor bronze. In some cases permeable layers or beds of tangled or matted wires or of slender rods, or woven fabrics, or perforated plates, strips, or boards of metal, wood, or other material, or rods, or strips or thin plates set edgeways of glass, wood, or other material, or layers of such fibrous, granular, or other permeable materials as have suitable interstices, may be used, and the vessels may be of brick or stone, and lead, earthenware, or other non-corrosive material may be used for supporting the screens.

When the furnace gases etc. include matters soluble in water or capable of combining with substances dissolved in the water, such as compounds of arsenic and of zinc, the apparatus will separate the soluble and suspended matters from the gases and from each other. After separation of the suspended matters by subsidence or filtration, the solution from the vessel may be treated with precipitants or otherwise. Thus, when smelting arsenical lead ores in a blast furnace, part of the lead and all the arsenic (as oxide or other compound) are volatilized; the lead compound may be recovered as a slimy deposit, and the arsenic compound in solution. The invention may be used when treating zinc ores in a blast furnace, to volatilize as much zinc as possible as oxide and sulphate, which can be subsequently reduced or otherwise treated, for the volatilized matters are efficiently recovered by the apparatus described. Also the

apparatus may be used for collecting sublimed arsenic or its compounds when its ores are treated.

[*Printed*, 8*d*. *Drawings*.]

A.D. 1878, December 24.—No. 5260.

SPENCE, PETER.—Calcining copper and other sulphurous ores and regulus, and treatment of products.

1. Referring to his prior Specification No. 64, A.D. 1868, the inventor now uses a calcining-furnace with several beds, the ground ore being stirred upon each by sets of travelling rakes and transferred from one bed to another until it is removed from the last. The beds are built one above another with floors one tile in breadth, supported on fireclay slabs which project from the side walls, the tiles when put together longitudinally making up the whole length of the bed ; but, according to the description of the drawings, an opening is left near one end or the other alternately of the successive beds for the descent of the ore on to the bed beneath. Ploughing and raking instruments (to which the prior Specification relates) alternately stir the ore and carry it forward toward the opening in each bed ; the faces of the instruments on succeeding beds being reversed, as the said openings are at alternate ends of the successive beds. The lowest bed has an opening for delivering the completely-calcined ore into a receptacle. The instruments are mounted in angle-iron bars provided with rollers, which run upon rails carried by the projecting fireclay slabs. The angle-iron bars are connected by rods to a wheeled frame or carriage, running on rails outside the furnace. A shaft, by pinions in gear with racks, causes the frame to traverse and thereby the instruments to move to and fro over the beds. Intervals of rest and cooling for the instruments may be arranged in accordance with the prior Specification. A channel may lead to the top bed from a charging-hopper, provided at the bottom with a sliding plate, which is formed at its inner end with a ledge, and by the aid of rods with stops is so actuated by the said frame that a certain amount of ore is delivered through the channel at each movement in one direction of the frame. Instead of the plate, the hopper may have a winged bottom. A double furnace is preferred, shown in drawings as provided with one frame. After starting, the temperature of the furnace is

self-sustained by the combustion of the material under operation, and practically the whole of the copper in cupreous pyrites or other sulphides will be converted into soluble sulphate.

2. Instead of again calcining such calcined ore or treating it with salt or other chloride, it is treated with water in vessels, thereby obtaining a solution of sulphate of copper, which may be precipitated as usual.

[*Printed*, 6*d*. *Drawings*.]

A.D. 1878, December 24.—No. 5277.

STEVENS, DAVID, and VIVIAN, ROGER.—Grinding and pulverizing ores etc.

A circular pan has perpendicular or oblique sides, and is fitted with a cover containing one or more radial openings for the discharge of the ore, which is fed into the pan by a hopper or shoot. On a renewable bed at the bottom of the pan revolves a circular muller or rubber, which has holes or vacancies for the ground ore to pass through. To the under side of the muller are attached shoes, which are jagged or serrated, forming teeth with an oblique front, and the upper edges of the teeth protrude above and in front of the grinding-surface of the shoe, the ore being triturated between the shoes and the bed. Stops slide in grooves in the radial openings in the cover, whereby the openings can be closed to within any desired distance of the centre, and the more they are closed the finer will be the state of division of the ore delivered from the machine ; or this may be regulated by a system of close-fitting rings. A current of water aids the operation. Ledges at the sides of the radial openings direct the ground ore into troughs. The muller is suspended from an axis which passes through the centre of the pan and is driven by bevel-wheels. A screw regulates the distance of the face of the muller from that of the bed.

A modified machine has an annular trough or pan with outlets over its sides at its outer and inner circumference. The muller is angular in section, the face carrying the shoes being formed together with a barrel, which rises from its inner edge and is perforated by oblique holes, so that any coarse ore, escaping between the shoes into the inside of the barrel, may pass back to be further reduced. The muller is connected to a wheel or arms revolving above the pan, the sides of which have inclined

deflecting-rings to guide the ore into the track of the shoes. The ring attached to the outer side of the pan directs the ore on to the top of the muller, and that attached to the inner side is fixed near the bottom and slopes upwards to direct the larger particles towards the holes in the barrel. The muller divides the pan into two compartments, and the ore can only reach the inner one by crossing the track of the shoes. It can be delivered from either or both compartments, and thus can be separated into two sizes when desired.

[*Printed*, 6*d*. *Drawing*.]

A.D. 1878, December 24.—No. 5279.

GLASER, FRIEDRICH CARL.—(*A communication from Hermann Kissing and Carl Möllmann.*)—(*Provisional protection only.*)—Cleaning wire.

The wire is made to pass between hinged frames, each bearing three steel rollers, which are so mounted that when the frames are closed together by a bar and catch, the rollers of one set come between the others, and guiding-grooves on two of the rollers cause the wire to turn on its axis in passing through them, so that it is bent and rolled in several directions.

[*Printed*, 2*d*. *No Drawings*.]

A.D. 1878, December 30.—No. 5314.

RIPLEY, ROSWELL SABINE.—(*A communication from William Harkness.*)—Furnaces.

Reference is made to the prior Specifications No. 2169, A.D. 1874, and No. 2069, A.D. 1878, which relate to making gas, and may be used in connection with the present invention. The latter refers to furnaces adapted to the use of gaseous fuel, and the employment of gases resulting from the decomposition of steam.

A puddling-furnace has "two bowls or boshes," separated by a bridge, above which another bridge or arch is placed to conduct heat from one bowl to the other. There are two heating chambers or compartments, located above the main arch of the furnace and communicating with the furnace by flues. Air from a blower and gas from a gas holder or generators are conveyed to the two respective heating-chambers. Two burners are provided with compartments for the gas and air and with

flues for leading the same to the place of ignition. The face of the iron burner is protected by a perforated tile. Pipes lead from the heating-chambers to the burners, drawings indicating that the gas and air are heated in traversing spaces in the chambers, placed alternately with other spaces or flues through which heated gases from the furnace ascend. A dome covers the heating-chambers and is surmounted by a steam boiler. A single furnace with doors on one side may be equal in capacity to two ordinary puddling-furnaces, or can be made into a double furnace of double the capacity mentioned by enlarging the bowls and placing doors on both sides. Puddling is carried on in each bowl alternately, a charge of metal being melted in one bowl by the waste heat from the other bowl while another charge is being puddled in the latter, and each burner being used alternately while puddling takes place in the bowl beneath it.

The arrangements include gas generators, a gasometer, connecting mains, pipes, valves, cocks, gauges, etc. An automatic valve comprises an inlet, seat, casing, outlet, and spindle connected to the seat of the valve and weighted so that the valve will open on any desired pressure being reached. The spindle passes through a cover over the seat and is packed gas-tight The heating-chambers may be placed horizontally side by side, or may be set at an angle of about 45 degrees.

Parts of the apparatus are applicable to heating and other furnaces in which gaseous fuel is used.

[*Printed*, 8*d*. *Drawings*.]

A.D. 1878, December 31.—No. 5336.

PHILLIPS, Sydney Moreton.—Pickling, swilling, annealing, coating, and cleaning iron and steel and other metallic sheets used in the manufacture of tin, terne, and similar plates.

The plates are pushed between rollers which feed them to movable guides operated by means of a rod and an eccentric carried on a shaft driven by a pulley. The guides deliver the plates to stationary guides which pass one above another through the tub containing the acid and water. When the plates are placed in the guides, a vertical bar or carriage is placed behind them supported on top and bottom rails, and arms on a shaft are revolved and strike the carriage, pushing it and the plates forward into the bath. Another set of plates are then placed

in the guides, and behind these another carriage, and so on until the first set moved onward by those behind are discharged into the swilling-bath, containing a constantly-changing body of clean water. While the plates are passing from the guides into the swilling-bath steam is conducted on to them by any suitable means, to remove the acid and prevent their drying.

After being taken from the swilling-tub the plates are passed through rollers on to a guide which conducts them between guides enclosed in a tube within a heating-chamber. The guide is movable by means of the rod of an eccentric on a revolving shaft to enable all the guides to be filled. A vertical bar or carriage is secured to the upper and lower bar, behind the plates, and pushes the plates down the guides. Another set of plates are then inserted, and another carriage, and so on until the first set are discharged on to a stage. During their passage they are annealed by heat from a furnace. They are removed from the cooling-chamber by tongs or otherwise.

The plates to be coated, after being immersed and coated with grease in any suitable way, are fed by rollers or other suitable means into a metal bath between rails on to longitudinal guides. A rod is then inserted in guides behind the plates, and is pushed forward by revolving arms to make room for more plates and rods, which are also pushed forward by the arms until the whole have passed through the bath. The plates are received on to a cradle, which is then raised by means of a lever, and the plates pass into a hollow bed-plate and between spring scrapers and rollers. From thence they pass to another set of scrapers or planishers, and upper rollers which deliver them from the bath. The pushing-rods are caught by spikes on an endless chain, and are by it delivered out of the bath. The scrapers serve to remove any "scruff" or superfluous metal adhering to the plates.

The plates to be cleaned are passed by suitable guides between rollers in a box to blocks fitted with scrapers, which remove the cleaning-substance and grease. They are then passed by other rollers between rubbers, plates, or boards covered with sheepskins or other suitable substance and which are moved vertically, by means of an eccentric or otherwise. After passing the polishers the plates are delivered from the box by finishing-rollers. All the rollers are revolved by worm gearing or other means.

[*Printed*, 8*d*. *Drawings*.]

1879.

A.D. 1879, January 11.—No. 128.

CARR, CHARLES, the younger.—(*Provisional protection only.*) —Metallurgical furnaces.

The improvements are applicable to furnaces for melting, heating, and annealing metals and alloys, and for "the refining "of copper and brass." A furnace for melting copper and brass has an outer casing of iron plates with an ashpit in the lower part and a firebrick combustion chamber in the upper. A space is left all round between this chamber and the casing, and the lower part of this space serves for the entrance of air, while the upper part is filled with sand or the like. The upper part of the combustion chamber is fixed upon iron shelves, while the lower part, which is also built upon shelves, is renewable without disturbing the upper part. Firebars are supported on bearers carried by brackets. Spaces are left for the entrance of air at the lower part of the combustion chamber between the bricks forming the lowest courses, and air also enters between the firebars to effect a vigorous combustion, dampers regulating the air supply. The fuel and melting-pot are introduced at the top of the furnace, and the products of combustion pass by an opening at the top and back into a chimney.

[*No Drawings.*]

A.D. 1879, January 11.—No. 131.

THOMAS, SIDNEY GILCHRIST.—Refractory basic bricks, linings, etc. for furnaces, converters, and vessels.

The inventor's prior and subsequent Specifications Nos. 289, 908, and 3975, A.D. 1878, and No. 1313, A.D. 1879, are referred to.

Magnesian limestone, preferably containing from 4 to 7 p. c. of silica, 3 to 5 of alumina and oxide of iron, and at least 30 of carbonate of magnesia, is fired (in blocks or lumps of small thickness) at a very intense white heat, thereby producing a hard, compact, and highly-shrunk structure. A mixture of the

crushed product and liquid tar may be moulded, preferably under great pressure, to form bricks and tuyères, which, after being dried at a sufficient heat to prevent subsequent softening in the kiln, are burnt at an intense white heat. The mixture may be also used for ramming open-hearth furnace hearths (including some furnaces having sides of lime bricks) and converter bottoms, and as a cement for bricks etc.

An admixture of the unburnt magnesian limestone or ordinarily-burnt magnesian lime may be sometimes used, and crude naphtha or other cheap oil or pitch may be mixed with the tar. If ordinarily-burnt magnesian lime be wholly employed, the bricks produced must be fired at even a higher and more prolonged heat, and they shrink much. Damp should be avoided.

[*No Drawings.*]

A.D. 1879, January 11.—No. 135.

BAZIN, Ernest.—Separating matters of different densities.

Especially for separating the metals from auriferous and argentiferous matters, the inventor employs a water vat, which contains a rotating vessel, having a cylindrical part filled with mercury, and having also a centrifugal "projector" with mercury in its bottom. Through a hollow central shaft (which communicates the rotation) there descends from a funnel above a vertical tube, containing a sufficient height of water to balance the column of mercury, and forming an inlet for the said matters mixed with a gentle current of water. The mixture issues at the base of the mercury column in the cylindrical part of the vessel, and the sterile matters (earths, sand, and quartz) of less density than the mercury ascend through it into the centrifugal projector, which is beneath the water in the vat, and the rotation of which throws them out into the vat; thus "filtration" through mercury and expulsion take place simultaneously. Gold in nuggets, owing to its density, will remain chiefly at the base of the mercurial bath; gold in powder, scales, or dust, when carried upwards, will not completely traverse the bath without becoming amalgamated; silver, less dense than mercury, will be susceptible of amalgamation in traversing the bath, especially when finely divided. Again, gold or silver, escaping from this bath without undergoing amalgamation, will become exposed to centrifugal separation beneath water without

being expelled with the less dense sterile matters, but will remain in contact with the mercury in the projector and ultimately be amalgamated. Inlet and outlet cocks etc. are provided. The ascent of the matters through the bath may be retarded by placing spirals around the said shaft in the said cylindrical part to lengthen the path to be traversed and cause friction therein. The variable inclination of the spirals and the rotation of the vessel and the spirals in one direction or the other will alter the rate at which the matters rise. Sometimes the shaft is armed with radial bars to subdivide the matters and retard their ascent. Again, the projector, which can consist of a double pan, may turn upon or around a stationary cylindrical mercury receiver, and be readily changeable for another of different curvature. A modified apparatus can work without mercury, the said tube being then removed. By using a tube with a bulb at the bottom, the employment of too much mercury may be avoided by the displacement of the bulb. Hot, acidulated, and saline water may be sometimes employed. The apparatus may be placed in a dredging-barge for combined working.

[*Drawings.*]

A.D. 1879, January 15.—No. 163.

GOULD, Frederick.—(*Provisional protection only.*)—Treating iron for the manufacture of casks or drums for containing turpentine, oils, or spirits.

Iron plates having been cleaned with muriatic acid or vitriol, immersed in cold water, and then heated nearly to redness, are painted where the joints are to be, first with muriatic acid, and then with a solution of zinc in muriatic acid, and soldered. They may be covered within by a solution of shellac in spirit.

[*No Drawings.*]

A.D. 1879, January 21.—No. 249.

MEWBURN, John Clayton.—(*A communication from John Wetson.*)—Machines for separating from earth and stones and washing gold or other metals and precious stones.

A hollow water-tight cone, having the wide end upwards, may oscillate on trunnions fixed to the top end of the cone. The

cone contains a revolving shaft with radial arms or agitators. The bottom of the cone has a casting with a central hole and stuffing-box, through which passes this shaft. The bottom of the upper part of the casting dips down towards one side, where there is a valve or cock to admit the gold into a locked drawer below, made of horse-shoe form to pass on each side of the shaft. The earth or soil for treatment is thrown into the cone and moistened with water. The metals being the heaviest substances make their way to the bottom of the cone and pass through the valve. By opening a small hinged side door in the cone, small stones and metal will fall into a tray, which revolves with the shaft but below the cone; and what is of value is selected as the tray goes round. Above the said casting the cone has numerous small holes which conduct the water into an outer cone, wherein it rises and is carried off from near its top. Any gold will not rise with the water, but will return through the holes, on the water subsiding. The inner cone is not quite encircled by the outer one, a space being left for the said small door, above which there is a larger door. A perforated circular plate or sifter is placed level with the bottom of the upper door. The trunnions carry the cone on a frame supported by columns and piles. The trunnions are forgings bolted to the top rim of the cone and stayed by iron cross beams, which are further stayed to the said rim. The cross beams carry the top central bracket or bearing for the agitator shaft, the top of which has a collar. A horizontal shaft passes through one of the trunnions concentrically with the centre of the cone's vibration: thus circular motion can be imparted to the agitator shaft, bevel-wheels being provided. The said arms are at an angle of about 60° from the vertical, and have twists in opposite directions to neutralize strain. A pump may supply water to the cone; and by a belt and pulleys the pump shaft may drive a side shaft carrying an eccentric, which is variable in throw and is connected by a rod to the bottom of the cone to impart oscillation thereto. The machine is portable in pieces and can be worked by a horse gin.

In a modified machine, upon the centre of the cone and beneath it there is a partly-globular pivot or foot, which fits into a bush or footstep in a recess formed eccentrically in a bevel-wheel; thus the base of the cone will be carried round in a small circle corresponding to the eccentricity. A beam is

secured to the top of, and stretches across, the cone. A hollow bracket, bolted on the top of the beam, forms the centre of motion of the upper part of the cone. The spherical bearing part of this bracket works in a bush, which is confined within a chamber formed on the lower end of a central main bracket, the latter being bolted to the fixed upper frame of the machine. An agitator shaft revolves always concentrically within the cone, the upper end of the shaft having a universal joint concentric with the hollow globe which works within the said bush. Bevel-wheels transmit motion to a vertical shaft working in the main bracket in connection with the universal joint. The cone has spouts or shoots to conduct away water and dirt. Besides the circular motion of the foot of the cone there is also an adjustable pendulous one, produced by a connecting-rod worked from a crank disc on a shaft ; thus the base of the cone moves in a circle, which is itself always being altered in position by going from side to side. The bevel-wheel which gives circular movement to the base of the cone is keyed on a shaft, which descends into a trunk forming part of a carriage with rollers. The latter roll on the concave surface of part of a cylinder, the centre of which is the said globular bearing of the top bracket. The same bevel-wheel receives motion from a side shaft by means of other bevel-wheels and an intermediate shaft, which is so mounted that it is free to vibrate, and also to move up and down at the cone end for meeting the requirement of the versed sine produced by the rolling of the said carriage on an arc. The carriage follows a slot curved to the requirement of the said end of the shaft, while its other end can move up and down slightly as required. Pinions on the carriage gear into racks to compel the required movement. A pump may supply an annular perforated pipe resting on the top of the framework, so that water is directed into the contents of the cone. There may be a flat instead of a concave surface for the said rollers, the mechanism being modified accordingly. In this case the arms or stirrers would rise and fall a little in the cone, owing to its changing position in its stroke or vibration causing a variation in its distance from the centre of oscillation, while the distance of the stirrers remained constant ; and the resulting slight up-and-down motion would produce a churning action by the stirrers.

[*Drawings.*]

A.D. 1879, January 22.—No. 257.

THOMAS, SIDNEY GILCHRIST. — Refractory bricks and furnace linings.

The inventor's prior Specifications Nos. 908, 3975, and 4063, A.D. 1878, are referred to.

The hard, very highly fired, shrunk lime, produced by calcining alumino-silicious dolomite (preferably containing from 3 to 5 p.c. of silica, about 4 or 5 of alumina and oxide of iron together, and over 27 of carbonate of magnesia) or equivalent artificial mixtures, may be mixed with enough crude petroleum or naphtha, heavy tar-oil, or similar cheap oil to moisten the mass. This may be used for ramming furnaces, particularly converter bottoms, but is preferably moulded under considerable pressure into bricks and tuyères. The latter are fired in a kiln gradually up to a very intense white heat, maintained for at least 24 hours. Imperfect basic bricks, made in accordance with prior Specifications, may be ground up and utilized. A little ordinary magnesian lime or finely-ground unburnt limestone may be used, and sometimes 1 or 2 p.c. of oxide of iron. Some tar or ground pitch may be mixed with the oil employed.

Liquid tar or crude creosote may be mixed with magnesian lime etc., for making bricks and to obtain a cement for bricks.

[*No Drawings.*]

A.D. 1879, January 22.—No. 269.

LYTE, FARNHAM MAXWELL.—Separating lead, zinc, silver, and copper in ores etc., by acids, brine, etc.

The inventor refers to his prior Specifications, Nos. 633 and 2807, A.D. 1877.

The ore or metalliferous substance is treated with acid to extract soluble bases, including zinc and copper, in a set of two or more attacking tubs, wherein the ore is successively treated first with partly-saturated and afterwards with fresh acid, so that the extraction may be rendered more complete, and the acid become well neutralized, which checks it from carrying off lead and silver with the zinc etc. The residue is afterwards treated with hot, strong, and sometimes acidulated brine until all the lead and silver have been dissolved. The brine is drawn off into a tank and cooled, whereupon most of the lead and of

the silver, if present in quantity, becomes deposited as chlorides; and the brine, after re-heating, will dissolve more lead and silver. Thus brine may be used repeatedly as a carrier of lead and silver from the ore to the depositing-tank. The accumulated deposit is washed with fresh cold brine, if needful, and it may then be reduced by lumps of zinc, when it will yield soft lead mixed with silver, which may be melted into ingots. Or by digesting metallic lead with the hot brine, all the silver may be precipitated and collected by a small quantity of lead to be subsequently cupelled. Lead, such as spongy lead formed by reducing chloride of lead by zinc, may be also used to recover the silver remaining in the cooled brine and any silver carried off by the acid. Antimony and bismuth, present in the ore, may be carried off by the acid or by the hot brine, from which, however, they do not separate on cooling; but their presence does not seem materially to affect the power of the brine to dissolve lead and silver. The process, therefore, affects a separation of antimony and bismuth from lead and silver. When soluble chlorides and sulphates have been previously extracted from the substance treated, the use of acid may be dispensed with. Solutions of other soluble alkaline, earthy, and metallic chlorides may replace brine, but generally without profit. The advantages specified include economy, completeness, and rapidity of operation.

Two or more attacking-tubs may be placed on a raised platform, and be fitted with taps or siphons for drawing off or decanting the liquors. At a lower level may be tanks to receive the saturated acid liquor and brine, respectively. The former tanks may be provided with steam coils and jets for heating and agitating the contents, and the latter with water coils for cooling.

[*Drawings.*]

A.D. 1879 . . . . No. 269.*

Disclaimer and Memorandum of Alteration to the Specification of the preceding invention, filed February 5, A.D. 1881, by Farnham Maxwell Lyte.

[*No Drawings.*]

A.D. 1879, January 28.—No. 343.

EADE, JAMES.—(*Provisional protection only.*)—Treatment of zinc.

Zinc plates (or other articles) may be plunged into a bath of linseed oil and subjected thereto, while it is in a state of ebullition, for 30 minutes more or less according to the thickness of the metal, its surface being afterwards cleaned. Plates thus treated possess great ductility and can be highly polished; they may economically replace lead or pewter, the natural rigidity of zinc being removed and its working facilitated.

[*No Drawings.*]

A.D. 1879, January 28.—No. 345.

SCOFFERN, JOHN.—Sheathing iron and steel ships.

A special solder is described consisting of ordinary soft solder with 3 p.c. of cadmium added.

[*Drawing.*]

A.D. 1879, February 1.—No. 414.

EDWARDS, RICHARD JOHN. — Stamping and grinding machinery.

For treating ores, stone, slag, etc., stamps, with approximately vertical circular spindles, working and capable of revolving in adjustable guides, may at their lower ends carry adjustable cast-iron, steel, or other hard and heavy blocks or heads with preferably circular lower faces. Beneath circular horizontal iron or other hard discs or plates, fixed on the spindles, there is a longitudinal driving shaft, carrying spirally shaped bars or cams, which lift the different discs and hammer heads of the set of stamps successively or simultaneously, and allow them to fall suddenly. There may be one cam for each disc ; or, if two, then one on each side of the spindle to avoid lateral action : or part of each spindle may be made as an open frame, within which the driving shaft works ; the cam pressing on a friction plate or roller in a line with the centre of the spindle and hammer. Or a separate transverse shaft and cam may actuate each spindle.

A cast-iron, steel, or other hard and thick anvil plate or block, rather wider than the hammer faces, travels directly

under them, for some distance to and fro, upon friction rollers, wheels, or guides. A hopper, with a charging receptacle at one end, surrounds the block and retains the ore under treatment, while its other end is open for delivery of the stamped ore. The block, which is somewhat longer than the set of hammers, slopes from one end to the other ; and as it moves to and fro (actuated by a toothed rack and segment or otherwise), a fresh part of its surface comes under the hammers at each blow ; the ore travelling slowly along the block and being pulverized by the hammers. The ore is also ground between the faces of the hammers, while at rest before being lifted, and the moving surface of the block : also grinding cylinders or rollers, pressed against the block, may be placed between the stamp heads. The block may have a renewable wearing surface, and may contain vertical perforations or gratings for the passage of sufficiently-reduced ore. Transverse plates or forks, fixed to supports and adjustably distant from the block, may be placed between the stamp heads to check the passage of insufficiently-stamped ore. A shield or cover, attached to the block, and dipping into water, may surround and keep dust from the friction rollers and bearings. Instead of, or in combination with, cams and lifting plates, each hammer head or spindle may be connected to the piston-rod of a separate, direct-acting, vertical, steam or compressed-air engine. The engines and hammer heads may be in a circle, and the heads strike upon a circular revolving anvil block.

[*Drawing.*]

A.D. 1879, February 6.—No. 481.

WALKER, Edwin.—Alloys.

Hooks and pegs, to resist the action of moisture and sulphur, may be made of a combination or admixture of 3 parts of tin and 1 of zinc ; and, when to be used in contact with sulphur, of a combination of 1 part of antimony and 5 of tin ; or 1 part of hard white metal and 4 of tin may be employed. Sufficient antimony or white metal must be used to harden the tin, as the proportions are varied. One ounce of antimony to one pound of tin might do.

[*No Drawings.*]

A.D. 1879, February 20.—No. 687.

LAKE, William Robert.—(*A communication from George T. Lewis.*)—Collecting the fumes from lead-smelting and refining furnaces.

A descending flue leads from the stack of the furnace to the first of a number of vertical sheet-metal cooling-tubes, about 2 feet in diameter, and 350 feet long altogether. The fumes are forced to ascend and descend successively as they pass through the tubes, which may have cleaning-out openings (with covers) for the small deposit. The last tube leads to the eye of a fan, by which the fumes are drawn through the said tubes and discharged into a horizontal tube, whence is suspended a series of strainers or bags formed of textile fabric or like material, through the meshes of which the gases escape, leaving the solid matter or fume proper within the bags. This fume is removed from the bags by shaking, and may be returned to the furnace or used for pigments.

Previous methods of collecting fumes are referred to.

[*Drawing.*]

A.D. 1879, February 21.—No. 708.

NEWTON, Alfred Vincent.—(*A communication from Alexandre Marin y Garcia.*)—Desilverizing auriferous and argentiferous lead.

Desilverization is conducted as usual by introducing zinc into the fused lead, after removing impurities (as antimony and iron) by discharging air at a pressure of about 2½ atmospheres into the bath. The induction pipe (connected to a force pump) is vertically disposed in the centre of the lead pan at a few inches from the bottom, and the scums thrown up by the air are oxides of antimony and iron mixed with lead oxide (and termed oxides No. 1).

The introduction of zinc produces rich scums, containing nearly all the silver and (after liquation of "the exceeding "lead") about one-third of zinc. A blast of air converts these scums into fine oxides of lead and zinc with unoxidized, intermixed silver (oxides No. 2).

The lead, which has given its silver to the rich scums, contains zinc. This is removed by an air blast, the result

being zinc scums fit for again desilverizing, and poor oxides of lead and zinc (oxides No. 3).

The poor lead is cast into pigs for sale as soft lead.

Oxides Nos. 1, 2, and 3, in a state of powder, are separately treated with concentrated vinegar (acetic or pyroligneous acid), and the silver present deposits in each case at the bottom of the vessel. The antimonial yellow oxide remains in suspension and is separated by filtration. The lead and zinc are dissolved as acetates, and (as well as the antimonial oxide) utilized as bye-products.

The silver deposit is washed in water, refined in graphite crucibles, and moulded into ingots; cupellation being avoided.

[*No Drawings.*]

A.D. 1879, March 7.—No. 902.

BROWN, Andrew, and BENNETT, Henry.—Washing and screening ashes, coal, coke, roll-scale, scrap iron, etc.

A rotary screen, composed of cylindrical ends and an enlarged central portion of cylindrical or square section, is mounted on rollers so that the central portion dips into a water tank. The screen is fitted with an internal worm or spirally-arranged division for feeding the material forward. One of the cylindrical end portions is covered with wire netting, the central portion with straight lattice wire, and the exit end with a screening-surface of variable mesh. The material is fed into one end, and carried through the screen by the worm or spirally-arranged division, being sorted, if required, at the exit end.

[*Drawing.*]

A.D. 1879, March 12.—No. 983.

HENDERSON, William.—Smelting copper ores, cupreous pyrites, and ores containing sulphides of copper and iron with such sulphides as of zinc, lead, antimony, and arsenic, and the precious metals; supplying air blast with steam, and constructing and lining furnaces; and separating sublimed oxides or sulphides from sulphur.

Reference is made to the prior Specifications of J. Hollway,

Nos. 500 and 1131, A.D. 1878, which relate to using the sulphur as fuel in treating pyrites &c.

The present inventor uses a blast furnace, which ordinarily need be of no great height and need not have the hearth and boshes much contracted, as the mixed sulphides and silicious ores treated are easily smelted in the absence of intermixed fuel. The upper part of the furnace, including the upper part of the boshes, is supported on strong pillars, while the lower part, including the hearth and part of the boshes up to two feet above the tuyères, is preferably removable and in one piece. This lower part has a perforated wrought-iron casing, giving space for 3 feet of solid hearth and 2 feet of a solid carbon lining all round to meet the firebrick lining 2 feet above the tuyères. After laying and baking or coking the hearth 3 feet thick, which may be constructed on a separate ring bolted to the superstructure, with dam and slopes for tapping clear and dry, the inventor constructs on the top of this the crucible and part of the boshes with inclined tuyère holes. To prepare the carbon lining, hard burnt coke of best quality (after being heated to expel all moisture) is ground in a pan or mortar mill to coarse sand or fine gravel, and sufficient well-boiled coal tar is added to slightly soften the mass, which should be dry enough to ram solid without adhering to a smooth-faced tool, a fire being placed under the pan to keep all hot. A perforated segmental iron core, shaped for the interior of the furnace and coated with whitewash to prevent adhesion, is now placed in the centre of the hearth and the carbon lining rammed in, tapered moulds to represent the tuyères being embedded in the carbon. The structure is then gradually raised to cherry redness in an oven or furnace, and kept so until the tar is thoroughly coked, after which this part of the furnace is fixed in its place. Again, the lining may be formed by baking or coking, in perforated moulds, blocks forming segments of the several parts, the cement consisting of coke and tar finer ground and softer, and all the blocks being coked into one solid mass by heating up the furnace.

At the said tuyères, which blow downward into the molten fluid on the hearth, a mixture of air and steam is employed, the steam acting as an injector for introducing the air. Above these is another set of tuyères for admitting a blast of air (ordinarily from a Root's blower) when required ; at other

times they are closed. The object is to obtain all the sulphur and sublimates evolved from the furnace, the proportions of air and steam employed being regulated so that the sulphurous acid and sulphuretted hydrogen produced will together form sulphur and water, without having an excess of either gas. Varying the pressure of the steam aids this adjustment.

The tunnel head of the furnace should have a cup and bell, and the gases are preferably drawn off some feet below the charging-place. The lateral openings should be large, numerous, and easily cleaned, as sublimates of lead, zinc, or arsenic will quickly close them up. Likewise the descending flue to the condensers should be wide and short, terminating in one or more large high brick chambers for these heavy sublimates to deposit in. Beyond there are long narrow chambers, wherein steam of low pressure is supplied. The floor of these chambers is glazed and formed in ridges and furrows, so that when the temperature rises the flowers of sulphur melt and run into the furrows, which have tap-holes. In the chambers nearest the furnace the sulphur may be mixed with the more volatile sublimates, and is separated therefrom by melting by high pressure steam ; the sublimates floating on the molten sulphur, which is tapped from the bottom of the boiler. The condensing-apparatus lastly has large towers which contain glazed bricks arranged like pigeon holes. A stream of water descends among the bricks to a cistern beneath, carrying with it the last traces of sulphur.

The heated furnace is charged with mixed ores, or ores and silicious matter, the blast being then increased to the full, and charging is continued as the previous charge sinks down. Cupreous pyrites, containing from 42 to 49 p. c. of sulphur and 3 to 8 of silica, in pieces about the size of one's fist or smaller, may be smelted with a highly-silicious copper ore or other silicious matter to form a slag with at least 30 p. c. of silica ; or a silicious clay slate may be used to form a double silicate. When the furnace contains molten stuff up to the lower tuyères, it may be tapped direct into a gas regenerative reversing reverberatory furnace, having a thick carbon bottom on iron plates and girders with an air space beneath. When the furnace is empty, the bottom is protected by a layer of sand. The charge from the blast furnace absorbs this sand in the slag and clears the bottom, a white heat being employed. Afterwards the

charge remains for half-an-hour; and then the regulus and slag are run out at separate tap-holes, one on each side of the furnace. Any foul slags are placed in the furnace when it is made ready for another charge. Sometimes partial separation of regulus and slag may take place in a lined heated ladle, which receives the tapping of the blast furnace, and conveys the same (after separation of some regulus) into the reverberatory furnace.

The air may be heated and steam superheated, when needful.

[*No Drawings.*]

A.D. 1879, March 17.—No. 1045.

MORGAN, William, DANIEL, Edward Rice, and HOWELLS, Llewellyn.—(*Provisional protection only.*)—Deoxidizing iron or steel or other metals.

Means are described for reducing oxides of iron, by passing hydrogen or hydrocarbons or compounds of hydrogen through a heated chamber containing iron or steel plates or articles to be deoxidized; or the plates may be coated with carbonaceous matter and heated.

[*No Drawings.*]

A.D. 1879, March 17.—No. 1046.

WILKS, Matthew, and HOWSON, Richard.—Metallurgical processes.

Reference is made to the subsequent Specifications Nos. 2594 and 3168, A.D. 1879.

After referring to the injection into molten iron, for the purpose of maintaining its temperature, of petroleum or other hydrocarbon with the blast employed, it is stated that hydrocarbons in the form of vapour "may be used with great "advantage not only for ferrugineous ores and their metals of "various kinds, but also in treating or smelting other ores and "metals, such as tin, copper, and other ores that may be treated "or smelted in an analogous manner." The hydrocarbons may be vaporized by traversing heated pipes and then mixed with the blast; when the blast is hot, hydrocarbon spray would be converted into vapour before reaching the molten metal. Blast may be passed through a tower containing porous material, to which the hydrocarbon is supplied and taken up by the blast.

[*Drawing.*]

A.D. 1879, March 18.—No. 1058.

WILLIAMS, William.—Melting, heating, and other furnaces.

The invention, which is illustrated by drawings of a puddling-furnace, relates to "introducing a mixture of air and "steam into the fire boxes or combustion chambers of furnaces "for supporting the combustion of the fuel therein by means "of one, two, or more pairs of pipes, supplied with steam jets, "symmetrically arranged on opposite sides" of the firebox; "the ends of the said pipes opening into a closed chamber "under, or under and at the sides of the fire box," and the mixture of air and steam passing from the chamber into the fire box through the perforated bottom and sometimes also through the perforated sides of the latter. Combustion may be controlled by regulating the steam jets. There are doors for introducing the fuel and for removing the ash. The flame passes over a fire-bridge into the puddling-chamber.

[*Drawings.*]

A.D. 1879, March 19.—No. 1089.

PITT, Sydney.—(*A communication from Henri Harmet.*)—Refractory materials.

To manufacture basic or carbonaceous bricks for lining metallurgical apparatus, as carbonate of magnesia cannot usually be obtained, the inventor takes dolomite, (carbonate of magnesia and lime), as little silicious as possible, and calcines it in large pieces at a red heat only; and then finely crushes it, sometimes adding lime, graphite, slow-burning coke, or other material. The mixture, much moistened, is now formed into bricks, which shortly become very hard and unalterable by air or moisture. The bricks may usefully contain fine cast-iron borings (or oxide of iron); when highly heated, the cast iron fuses and combines with the magnesia, thereby checking a tendency to disintegrate. A mortar made of calcined dolomite, moistened only at the moment of using, is preferred for setting the bricks. A basic carbonaceous brick, suitable where an energetic reductive action is desired in presence of a basic slag, may be produced from an intimate mixture of equal weights of calcined dolomite and carbonaceous matter. The crucibles of blast furnaces, soles of gas furnaces, tuyères and bottoms of

converters etc. may be made from the mixtures, which may be rammed in place instead of being formed into bricks.

[*No Drawings.*]

A.D. 1879.—March 25th.—No. 1182.

CLERK, Dugald, and FAWSITT, Charles Albert.—Coating or protecting iron, steel, or their compounds.

Platinum is welded to the cleaned surface of the other metal by the action of heat and pressure or concussion. The coated metal, which is thus protected from oxidation, may be afterwards formed into articles, such as tuyères, retorts, or furnace bars, by mechanical treatment.

[*No Drawings.*]

A.D. 1879, March 26.—No. 1202.

SMITH, Thomas James.—(*A communication from Ludovic Reine Raoul, Comte de Beaurepaire de Louvagny.*)—Washing roots, "gangues," minerals, nodules etc.

Machines adapted for washing roots are described. They may be made of wood or metal, and mounted on legs or wheels. There may be a tub and an interior cylinder-sieve, which can be turned or rocked by a lever to drain or to empty out the contents. An axle, on which are adjustable arms or agitators, turns in the interior sieve, a crank handle giving rotation.

[*Drawing.*]

A.D. 1879, March 29.—No. 1265.

BULLOCK, Joseph Howell.—(*Provisional protection only.*)—Puddling, mill, and air furnaces.

Two or more gas generators are "formed inside the "ordinary fire-grate" of the furnace by a divisional wall, built perpendicularly between the back of the grate and the fire-bridge of the furnace from the bearing-plate to the crown of the combustion chamber. The said wall becomes sufficiently heated to distil the gas from the small fuel with which the generators are charged. The gas enters the combustion chamber through apertures in the wall and becomes ignited by the fire on the grate, which is fed through apertures in the back plate and corresponding apertures in the wall. The ordinary

fire-hole is built up to exclude cold air. Air enters at the chimney end and passes under the bottom of the furnace to the grate, which is enclosed. Besides economizing fuel, there is an "improvement in the yield" and the work of the puddler is expedited and lightened.

[*No Drawings.*]

A.D. 1879, April 1.—No. 1291.

HART, BENJAMIN WOOLLEY.—Separation of minerals etc. of different densities.

The sides of a box converge from near its back to its narrow front (or it may have only one converging side), its greatest width being thus at its back. Its greatest depth is also at the back, so that when its bottom is horizontal its upper edge will be higher behind than in front. A sieve-bed, of woven wire, wire gauze, or perforated metal, is secured in a frame fitted closely to a ledge, and forms an inclined plane from the back to the front of the box. (The sides of the box, however, may be level instead of sloping.) The depth of the mineral layer on the bed having been determined, the containing or confining sides (forming an upward continuation of the sides of the box) are made of a corresponding height by means of a vertical removable flange, preferably flat on its inner and sloping on its outer surface, to ensure the discharge of the lighter mineral over the same; but at the back or hopper end the said height is preferably greater. By contracting the bed at the front, the heavier mineral will be collected here within a narrow area, and its passage thence into a receiver may be regulated by an adjustable hinged valve or gate. Sometimes the box has a false bottom below and approximately parallel to the sieve-bed. A feeding-hopper, whence the mineral to be treated descends and spreads forward on the bed, preferably has a pivoted or hinged plate, adjustable by a screw or otherwise to control the feed.

Air from a fan or compressor passes to a valve-chest, attached to the lower central part of the back of the box, and containing a flap or other valve, which may be opened and closed, say, 400 times a minute by the action of levers, pawl, and rotating ratchet-wheel; thus the supply of air to the box or air-chamber below the sieve-bed is effected. The chest has a preferably light relief valve, loaded with metal discs, to control

the pressure of the air (which is indicated by a pressure gauge); so that, when the flap valve opens, the lighter mineral or gangue may rise without the heavier rising appreciably, and, when it shuts, the heavier may fall without the lighter falling appreciably. The lighter mineral, being carried forward along the bed, overflows the sides which extend diagonally to its travel, while the heavier passes on to the narrow front to be discharged. The flap valve and oscillating action of the air may be sometimes dispensed with, and a continuously ascending uniform current of air operate on the mineral on the bed.

[*Drawings.*]

A.D. 1879, April 9.—No. 1409.

DAVIES, David.—Coating iron plates with tin or other metal, and cleansing such plates.

The apparatus for pickling the plates consists of a direct acting steam or hydraulic crane having four horizontal jibs or arms which carry cages to contain the plates. In commencing operations, a cage is charged with plates carried round by the crane and lowered into the acid tank, another cage being at the same time brought into the position for charging. The acid tank is supported on a reciprocating table so that it can be moved backwards and forwards, thus bringing fresh acid in contact with the plates suspended in it. The cage is then raised and lowered into a water tank, which is similarly supported, another cage of plates being simultaneously lowered into the acid bath, and a third cage being brought into the position for charging. The cage is raised from the water tank and deposited in a fourth position, where the plates are removed and the cage is ready to be carried forward for recharging. Other methods of agitating the plates or the liquids may be used. The tank of acid or water may be made deeper and the cage may be moved up and down in it, or the tanks may be carried on a hydraulic ram so that they can be raised or lowered, the cage of plates remaining stationary.

In the tinning bath, each plate is passed between guides and is carried forward by an endless band working below the surface of the molten metal and provided with a series of stops by which the plate is maintained in position. When the plate reaches the other end of the bath, it is taken hold of by rollers, by which it is delivered to washing rollers, and thence passes to

finishing rolls. The apparatus works continuously, plates being supplied at such a rate that one is carried forward by each stop. The bath may be of any shape ; the plates may be carried round on the underside of the endless band, or they may be carried through the bath in a vertical position. In another method of conveying the plates through the metal, a disc wheel rotates over the bath and is provided with a series of fingers, a plate being carried forward along guides by each finger till it is taken hold of by rollers. The finger coming in contact with the grease pot is pushed back, passes over the pot, and is brought into position again by a spiral spring.

The washing roller apparatus consists of three rollers working in a box, two of the rollers being upon fixed axes, the third roller being adjustable by a handle to which is attached an eccentric. Four rollers may be used in place of three, or in place of rollers hexagonal bars may be used.

For cleaning the plates an oblong box is provided mounted on large wheels with which it rotates, and having a rack inside to receive the plates. The plates are placed in the rack ; the box is charged with cleansing material ; the top is secured in its place ; and the apparatus is drawn to the sorting room. As the wheels revolve the box rotates, and the cleansing material will be brought in contact with and will clean the plates. A similar apparatus may be made to contain a larger number of plates, in which case it consists of several such chambers mounted on a fixed axis.

The dusting apparatus consists of a pair of revolving dusters, fitted on a hollow cylinder working in bearings, with a central blast pipe passing through hollow trunnions. The pressure of the blast causes the dusters to expand, so that they come in contact with the plates, and dust them without damaging the surfaces. In a modification of this apparatus, revolving cylinders are provided with brushes, a blast of air from the central axis being used to blow dust off the plates.

[*Drawings.*]

A.D. 1879, April 9.—No. 1421.

BULL, Henry Clay, HOPE, William, and RIPLEY, Boswell Sabine.—Metallurgical processes.

Ores, metals, alloys, metalloids, etc. may be treated (including

melting, reducing, purifying, and alloying) with gaseous blasts (including air, oxygen, hydrogen, carbonic oxide, coal gas, etc.,) and sometimes pulverized solids or vaporized liquids, which are generally blown through the molten or melting substances treated. All ores can be reduced, with suitable provision as to the fluxes, to the temperature and to the quality of the blast. Different blasts may be used in succession to effect definite chemical actions and produce pure metals or alloys. An air furnace may be employed, lined with gannister (with or without asbestos), bull dog, or plumbago, and provided with two or more receptacles between the fire and the chimney. The lowest is the purifying pot and is placed next to the fire, and the others are melting-pots or shelves, communicating with the purifying-pot by a passage outside the furnace. The charge may be let gently down into the furnace through an opening. Ores may be charged in a cage, having a bottom which opens. The blasts and gas, when used as fuel, may be heated in pipes in the chimney. A blast is maintained through the fire, or through the gas tuyères, gas burners being arranged round the purifying-pot when a gas furnace is employed. For introducing blasts into the molten metal, a straight counterbalanced plunger pipe, depending from a swinging joint, and provided with radial or tangential lateral holes or an open end, may be employed. This pipe can be applied to any furnace having a roof, or a Bessemer converter can be altered to receive it, with gas burners pointing downwards. "Water gas," as made by W. Harkness of Rhode Island, U.S., may be used for heating.

As regards casting, pressing out flaws and blow holes, and condensing or separating metals, alloys, etc., by gravity, centrifugal force, and abstraction of caloric; a heated mould, rotating at a high velocity, may be employed to produce powerful compression on the liquid metal. The atoms may solidify successively inwards, and very strong castings are obtainable. "In the "case of mixed ores or substances containing ores, when the "matters in combination with the metals have been expelled, if "the residual metals do not form alloys, amalgams, or chemical "union, the heaviest metal will be driven by centrifugal force "to the circumference, the next heaviest against it, and so on," and the metals may be separated when cold. "To separate "different metals, metalloids, or other substances of different "specific gravities, the internal shape of the mould should be

"that of two truncated cones, one inverted and the other "resting on it:" thus good lines of demarcation are obtainable. An antifriction cone arrangement may be used for, in fact, floating a mould in oil, while rapidly rotated; and sometimes a mould may be centrally cut out of metal plates bolted together.

[*No Drawings.*]

A.D. 1879, April 17.—No. 1509.

JOHNSON, John Henry.—(*A communication from James Spooner Howard, Francis Gordon Bates, and Frank Palmer Pendleton.*)—Making aluminium and its alloys.

Aluminium may be obtained by subjecting a mixture of say, 1 lb. of oxide of aluminium (generally produced by precipitation by means of carbonate of soda from a solution of alum, with subsequent washing and drying), 1 oz. of pulverized charcoal or coal, and 3 oz. of common salt to a temperature of about 700° Fahr. in a crucible or (when working on a larger scale) furnace, carefully closed to check the escape of vapours and gases.

To form aluminium bronze (containing copper and zinc), oxide of aluminium and oxide of zinc or metallic zinc may be thoroughly mixed with molten copper in a crucible (or furnace), the cover of which should be raised to ascertain that the alloy is very fluid before casting into ingots. The proportions employed vary with the desired character and colour of the alloy. For a deep gold-coloured alloy, 1 lb. of oxide of aluminium, 6 oz. of oxide of zinc, and 2 lbs. of copper may be used. An alloy of copper and aluminium may be made without zinc, but the addition of even a very little zinc produces a more perfect alloy. An alloy of copper, tin, and aluminium may be made by adding oxide of aluminium to fused copper and tin. Other metals may be added to copper; or nickel may be added to white alloys when a brilliant surface is desired. The claim is not limited to producing alloys of any particular metals with aluminium.

[*No Drawings.*]

A.D. 1879, April 24.—No. 1618.

TURNOCK, Joseph Rushton.—Tin and terne plates.

This invention relates to the brushing or washing of tin

plates. One or more pairs of brushes are kept close together by springs or otherwise. The plates may be fed by hand, between the brushes and drawn through by a pair of rollers, or they may be delivered to the brushes by rollers, or preferably the plate may be raised from the pot by a cradle and delivered at once to the brushes. To make the brush, the counterpart is placed in a frame, with the pins standing up, and the hemp is placed evenly along and round the pins ; the handle is then pressed down until the pins can be engaged by nuts, when it may be tightened as required ; the brushes are then placed in suitable frames. The brushes may either be made into a separate machine, or they may be used in the finishing-pot in connection with the rollers. The brushes may be of hemp or other material, or when used in conjunction with rollers, of asbestos or other refractory substance. Roller brushes may be used.

[*Drawing.*]

A.D. 1879, April 29.—No. 1682.

DERING, GEORGE EDWARD.—Linings for furnaces etc.

Sawn blocks of gas-retort carbon, cemented together by a mortar made of ground coke and tar, form hard and dense carbonaceous linings. A converter, vessel, or furnace may be lined with calcareous, aluminous, or other basic or neutral materials (especially when subject to great shrinkage from heat) by compressing the same, in a pulverulent or plastic condition, into place by tools or surfaces actuated by an hydraulic press or other sufficiently powerful mechanical appliance for considerably reducing the bulk and increasing the density of the lining, which is preferably highly fired before use. Reverberatory and open-hearth furnaces may have their linings compressed by direct vertical force. A slightly-tapering circular mandrel may be introduced into the strong cylindrical casing of a revolving furnace or a converter, the lining-material is tightly rammed between the two, strong annular ends are attached to the casing, and the mandrel is forced or drawn completely through the casing, thus strongly compressing the lining. Iron turnings, borings, or small scrap, sometimes previously rusted on the surface, may be mixed with basic lining-materials to bind and hold them together.

[*No Drawings.*]

A.D. 1879, April 29.—No. 1691.

CHALONER, George. — (*Provisional protection only.*) — Refractory bricks, furnace linings, etc.

Lime, preferably highly-fired shrunk magnesian lime or ground basic bricks, (for which see the prior Specifications of S. G. Thomas, Nos. 908, 3975, and 4063 A.D. 1878), is ground with linseed or other cheap animal or vegetable oil (preferably "boiled oil") or melted fats, sufficient to moisten it ; and is then, preferably under great pressure, formed into bricks or tuyères, which should be slowly dried and very highly burnt. Also the mixture, which may contain a little oxide of iron to increase the coherence, may be used as a mortar for lime bricks, or for ramming the bottoms of converters and the hearths of iron and steel furnaces.

[*No Drawings.*]

A.D. 1879, May 3.—No. 1758.

DAWES, John Thomas.—Dressing ores etc.

The crushed or powdered ore is introduced with a stream of water into a vertical hollow cylinder, around which, and rotating with it, is an archimedean screw, the stream of ore being delivered on the broad thread or blade of the screw, which rotates in a direction for raising anything on its blade. The whole is surrounded by a fixed hollow cylinder. The obliquity of the blade is such that the lighter particles of earthy matter are raised and pass away at the upper part of the apparatus, while the heavy particles of pure ore fall to the bottom, separation being thus effected.

Apparatus for triple treatment of the ore may comprise three hollow vertical cylinders, open at top and bottom, and fixed upon a tank. Within each fixed cylinder there is a vertical axial shaft supporting a rotating cylinder, which carries an archimedean screw enclosed by an attached cylindrical case, the latter rotating freely within the surrounding fixed cylinder. The shafts are geared together by toothed wheels so as to rotate at different velocities, motion being communicated to one shaft by a driving-pinion in gear with its toothed wheel. The said tank communicates with a feed water tank, and the latter with a waste-water tank. The ore with a stream of water is conducted into the first rotating cylinder, and passes through

openings on to the blade of its screw beneath the surface of the water in the cylinder. The heavier particles descend, while the lighter are carried with water up to the top of this cylinder, and pass into the second and more slowly rotating cylinder, where a further like separation takes place, and whence the lighter particles pass into the third and still more slowly rotating cylinder for a third separation.

To detach particles of ore, if adherent to the screws, their rate of rotation may be increased at intervals by eccentric gearing; or a rising-and-falling or jarring motion may be given to them by projections or grooves in the foot plates or by means of cams. Other liquids may replace water, if unsuitable.

Again, separation may be effected in a strong vessel containing water, the density of which is so increased by compression as to exceed that of the earthy particles. These rise to the upper part of the vessel, while the heavier particles remain at the bottom.

[*Drawing.*]

A.D. 1879, May 6.—No. 1785.

KNIGHT, William Henry Nunn.—Cleaning and tinning metal plates and preparing for white pickling, and so avoiding black pickling and annealing.

The plates are passed between rollers covered with elastic material to remove adherent water, then between revolving discs, which are covered with soft material and which revolve on spindles and are driven from any prime mover. The inner surfaces of the discs are supplied with grease through a pipe. The plates pass from these discs between rollers into the tin pot; from this they are raised by any suitable apparatus, passed upwards between another pair of rolls, and then between brushes.

In place of rotating discs, boards may be used which have a reciprocating motion and thus subject the plate to rubbing.

The pressure of the rolls is regulated by a spring balance in connection with levers which act against the bearings of the rolls.

A scouring-machine is described, consisting of two horizontal wheels or rings, which are mounted on a vertical axis and driven by gearing, being so arranged that the distance between them

can be altered as required. When used for scouring, the inner surfaces of the rings are made of emery or similar material ; when used for cleaning, the inner surfaces are of felt. The plates having passed between these rings pass between rolls, and fall into a receptacle below the machine.

For pouching, a box, about half filled with fullers' earth mixed with bran pollards or other substances, is mounted upon a horizontal axis, and is capable of being turned by suitable gearing. The plates are put in a rack in the upper part of the box which is then closed and turned upside down so that the plates come in contact with the fullers earth etc. ; when sufficient time has elapsed for the absorption of the grease, the box is returned to its former position and the plates are removed.

[*Drawings.*]

A.D. 1879, May 8.—No. 1842.

LAKE, William Robert.—(*A communication from Clarence M. Buel.*)—(*Provisional protection only.*)—Crushing and separating ores etc.

A spring beam is made up of laminated plates of spring steel or flat pieces of wood, formed with tapering ends and superposed so that the depth of the beam from the top plates to the bottom ones increases gradually from one end (to which a stamp head is connected) for about two-thirds of the length of the beam, and then decreases to the other end. Metal bands or ties connect the separate plates at the deepest part, where also the beam is mounted on trunnions or gudgeons, so that it can receive an oscillating movement by power applied to its short arm, and deliver blows by its long arm. To this arm the stamp head or hammer is connected by a rod working in guides, a screw being provided to shorten or lengthen the rod, in order that the travel of the stamp head and weight of the blow may be regulated for different materials treated. Besides the greater movement of the long arm (compared to the short), it is very elastic and receives a springing motion. The elasticity of the beam causes immediately an advantageous recoil of the head after giving a blow. Both dry and wet stamping are in view.

The mouth or outlet of the case of a fan communicates directly with the coffer or chamber wherein the stamp head

works. The fan is driven by a belt, and a speed pulley is placed on the fan shaft for varying the speed quickly to suit different materials. The air blast produced is regulated to carry off only the sufficiently-reduced material into chambers, the finest being blown to the most distant chamber, and the less and less fine to nearer chambers.

The invention also relates to special treatment of pebbles etc. for making pottery, and to "beetling" cloth. The machinery is constructed in separate parts for convenient transport.

[*No Drawings.*]

A.D. 1879, May 8.—No. 1844.

LAKE, WILLIAM ROBERT.—(*A communication from Jean Marie Antonin Thiollier and Paul Marie François Laurent.*)—Using gaseous fuel in cupola and like furnaces.

Shaft furnaces (high and low blast furnaces, cupola furnaces, and the like) may be used for reducing, refining, and oxidizing in treating ores and metals, including iron, manganese, copper, lead, tin, nickel, and cobalt. A blast of heated air may be divided, one part going directly into the furnace and the other into a gas generator, and the very hot gas produced may pass directly into the furnace through tuyères. The air is admitted to the furnace "through adjacent tuyères, opposite or con-"centric thereto," to effect a rapid intermixture of the air and gas. Ore to be reduced may be mixed with solid carbon (coke, charcoal, coal, etc.) ; or carbon in powder may be drawn into the furnace by the current of gas. Pure gas may be also introduced "at a certain height above the tuyères" to completely reduce the ore before fusion. By using hot air and gas a high temperature is attainable ; and by varying the proportions of the gas, air, and solid carbon, if used, regulated reducing or oxidizing actions may be obtained, while the prevention of contact between the ore and fuel conduces to purity of the products. Pigs or more or less carburetted metal may be produced according to the intensity of the reducing action. Products fit for immediate use will result from the treatment of some ores, but it is generally needful to refine the products of the first melting (pig metal, matts, and speiss) by re-melting once or oftener in an oxidizing atmosphere in a smaller furnace with suitable fluxes for scorifying the impurities. The

refining is rapid: "each drop melted traverses an oxidizing "atmosphere" and then a bath of purifying scoria. Also, as the proportions of gas and air are under control, there is no danger of oxidizing the metal.

For sulphuretted ores, the melting will take place in presence of sufficient air to expel the sulphur without oxidizing the metal: air introduced above the tuyeres will aid the expulsion of sulphur. The product will be a very rich matt or the metal. "Arsenious or antimonious ores" will be likewise treated.

[*No Drawings.*]

A.D. 1879, May 9.—No. 1846.

ABBOTT, James, junior.—Heating and puddling furnaces.

To avoid loss of heat, the roofs or crowns are so constructed that the products of combustion and heated gases shall travel in contact with the whole of the surface of the metal under treatment. One or more longitudinal courses of the brickwork of the roof are suspended from above by girders and hanging bars or cramps. The brickwork is filled in from the suspended courses (or sets of key bricks) to the sides, and from one course to another. Thus the roof may be made flat or nearly so, or arched downwards instead of upwards.

[*Drawing.*]

A.D. 1879, May 9.—No. 1855.

SPENCE, John Berger.—Treatment of metallic sulphides.

The sulphides, principally ores containing lead, zinc, iron, copper, and silver, after being finely powdered, may be calcined in a furnace designed for treating fine ores. By adding some already calcined ore, which assists in oxidizing the uncalcined ore, the latter is calcined sweet in less time and its agglomeration prevented.

The calcined ore is afterwards treated with enough sulphuric acid to sulphatize all the metals present, and is then re-calcined until the iron becomes peroxidized and rendered insoluble. On subsequent treatment with water, the sulphates of zinc and of copper with traces of silver are dissolved, and from the resulting solution the copper and silver are precipitated by adding metallic

zinc. From the residue (containing the sulphate of lead, the silver, and the peroxide of iron) the lead and silver are dissolved and separated by known means.

The invention also relates to obtaining pigments etc.

[*No Drawings.*]

A.D. 1879, May 9.—No. 1856.

PINKNEY, WILLIAM.—Furnaces.

In applying to puddling and like furnaces arrangements for heating air passing to the fire and to the unburnt gases therefrom to consume the latter, the inventor forms round the fire-hole door a casing with openings (provided with regulating doors or slides) at the outer and lower part to admit air, and with others at the upper and inner part for the exit of the air which has become heated in the casing. Also hollow firebars (preferably formed in halves) are at their open fronts provided with doors or slides, or a flap controlled by a ratchet and bolt, to regulate the amount of air entering the bars from the atmosphere; the bars communicating at the rear, directly or by means of a flue, with a hollow firebridge, the top of which has a perforated plate for the escape of the now heated air into the furnace: this air meets the inflammable gases passing over the bridge and burns them. Besides a door for giving access to the interior of the bridge in metallurgical furnaces, inlets, controlled by doors or slides, are provided to admit cold air. Between the lower part of the fire-door or its casing and the upper part of the firebars a slit may be left for admitting a poker without opening the door. When there is a dead plate in front of the firebars and flush with the lower part of the fire-door or its casing, the open fronts of the firebars are arranged below the dead-plate.

[*Drawings.*]

A.D. 1879, May 9.—No. 1858.

ALLEN, THAINE, and PAXMAN, JAMES NOAH.—(*Partly communicated by Samuel Stonestreet*).—Washing-machinery.

A hollow cone or distributor is fixed, vertex upwards, on a vertical shaft, which carries above a supply hopper having outlet holes at its lower edge opening on the distributor. There may

be guides forming channels from the outlets of the hopper to the periphery of the distributor, which is connected to the shaft by fixed radial arms, carrying vertical knives or agitators. The shaft is rotated by gearing, the agitators revolving in an annular trough, shaped like the frustrum of a cone, and having quite smooth bottom and sides. A raised rim, lower than the outer edge of the trough, forms an inner concentric overflow outlet. The conical distributor may be replaced by a number of inclined shoots, radiating from the outlets of the supply hopper to a curb ring, to which the outer ends of the agitators are attached. Again, the supply hopper may be dispensed with. The arrangement secures an equable distribution of the puddle or material to be washed, and loss is prevented. By the action of gravity and centrifugal force, the heavy particles, including ilmenite, iron, and stone, are retained in the trough, and the lighter matters flow inward and are discharged.

Washing diamonds is especially proposed.

[*Drawings.*]

A.D. 1879, May 10.—No. 1870.

CLAUS, Carl Friedrich.—Materials for furnaces.

The inventor refers to his prior Specification No. 1074, A.D. 1868, which relates to like subjects.

Furnaces and apparatus for the conversion of pig iron into malleable iron or steel may be constructed of or lined with non-silicious materials, viz., lime, magnesia, or aluminia, or mixtures thereof; and the cohesion of their particles is to be produced by using non-silicious materials, including the chlorides of calcium, magnesium, iron, and sodium, and fluoride of calcium, in solution or in fine powder; or the lime etc. may be exposed to the action of liquid or gaseous hydrochloric acid or chloride of iron. The lime should be very highly burnt, and mixtures containing alumina (bauxite) should be intensely heated to render the material denser and more unalterable. Sometimes the mixtures are obtained in other ways, as by decomposing chloride of aluminium by lime. The prepared materials are best suited for "ramming," but may be made into bricks or blocks. When used for lining furnaces, contact with brickwork should be avoided.

[*No Drawings.*]

A.D. 1879, May 12.—No. 1885.

WISE, William Lloyd.—(*A communication from Albert Piat.*)—Furnaces for heating and melting brass etc.

1. A furnace containing a crucible may be supported by a frame mounted on a platform, which has a carriage movable on rails by a hand-wheel and bevel gear. The platform can be moved laterally on the carriage between anti-friction rollers by a lever arrangement with a toothed wheel or segment and rack. Air passes to the furnace through a chamber at its lower part. The grate has removable bars, supported by round bearers and carrying a slab or block, whereon rests a crucible, which is kept in place by a seating of refractory material rising level with the lip of the crucible. The furnace has a central set of pivots or trunnions, and another set to one side. The frame carries a windlass arrangement, which, by a chain attached to the furnace at its lower part enables the furnace and contained crucible to be tilted on the side trunnions for pouring out the fused contents. When the furnace is used independently of its carriage, the central trunnions serve for lifting and tilting. Upward, longitudinal, and transverse movements can be effected for charging the crucible and for adjusting the point of discharge in relation to a mould.

2. A like furnace, without the carriage, may be connected to a "recuperator," which is formed of cast iron in two parts joined together, and has straight passages for the descent of the hot gases of combustion from the upper part of the furnace or crucible chamber. The recuperator, which is set in masonry, also has tortuous passages for the gradual ascent of air, which thus becomes heated by the escaping gases on its way to the furnace, the heat being rapidly conducted through the thin divisions of the recuperator.

3. Two or more like furnaces (provided with tuyères) may be so combined that the heated gases from one shall pass through the next, already charged with metal to be melted, thereby heating this charge; so that when this furnace is lighted (after completion of the fusion in the other and now recharged furnace) the combustion in the same is more rapid and economical; thus each furnace acts as a recuperator for itself and in connection with the contiguous furnace. Each furnace has a wind chest or chamber for supplying the tuyères; and products of combustion from the adjoining furnace may escape

through it. There are air passages provided with regulating-dampers. The masonry for supporting the furnace frames is arranged behind, so that the furnaces are free to be tilted forward for pouring the fused metal direct into moulds.

[*Drawings.*]

A.D. 1879, May 13.—No. 1905.

ANDREWS, Joseph Thomas.—Wrought-iron pots for melting silver and other metals.

The inventor cuts out from wrought iron a circular disc or blank, preferably with its edges or marginal parts thinner than the middle. The thin circumferential or marginal parts having been raised to a welding heat, the blank is operated upon in succession by two or more drawing-through or raising dies and a shaping or finishing die, in conjunction with punches or plungers. These force the blank into the dies, and so fashion it into a melting-pot. Each raising die contains a taper hole, the size of the holes progressively diminishing from the first to the last die ; and the finishing die is cylindrical, or partly so and partly conical, and has a closed hemispherical or other bottom, to which the end of the cylindrical finishing plunger corresponds in figure. The other plungers may be conical or cylindrical. By the taper dies and their plungers, the thin heated marginal parts are first gathered in and a cupped taper figure is given to the blank, while the finishing die and plunger convert it into a cylindrical pot with a hemispherical or other bottom. The plunger may be made in three or more segmental parts expanded by wedges, on removing which it contracts and may be withdrawn from the shaped pot : or the plunger may be readily removed, when made in one piece, by first slightly annealing the pot. When hydraulic pressure is used, the plunger may be connected to the ram of the press, and the stationary taper and cylindrical dies be fixed to the head of the press.

When a flange is required at the mouth of the pot, the flange is afterwards formed from the upper edge by heating the pot and placing it in a bottom die with a slightly taper plug within it. The bottom die is then raised into contact with a top tool having a shaping shoulder and recess : and the edge of the pot then becomes upset and spread laterally, and takes

the figure of the shoulder and recess to form the flange. There is an expansion to form the lips or gripping-parts of the pot, and a cross depression for its spout.

[*Drawings.*]

A.D. 1879, May 14.—No. 1926.

JOHNS, William Albert.—Manufacture of tin and terne plates.

A pickling chamber or tank is shown containing guides for conducting the plates through the acid or composition, and provided with arms which can be made to revolve on an axis for clearing the plates out of the bath. Steam may be introduced, and there is a cover to the bath to preserve the plates from contact with the air. The plates on leaving the bath are delivered into a vessel containing water. In place of the usual acid bath, a composition of a mixture of such substances as coal tar, wood tar, oil of wood tar, coal coke or charcoal in powder, petroleum, sawdust, and sal-ammonia may be used. The plates after being passed through this composition are piled evenly, packed in the annealing-boxes, and heated to redness.

One form of tinning-bath is preferably of a semi-hexagonal shape in vertical section, and is provided with three sets of slotted guides fixed in a frame for the passage of the plates, two upper sets and one lower set. Plates are put alternately into the two upper sets and are pushed forwards, the edges of the plates being slightly turned up so as to prevent overlapping. Between the lower guides is a bearing guide slotted on its upper surface, through which travels an endless band or wire provided with studs or projections, by which the plates in the lower guides are carried forward. The plates, having passed through the bath, pass between frames carrying light steel blades, which remove impurities from the surface of the plates, and which also act as guides from the bath to the delivery rollers. The plates are then passed into a grease pot, from which they are lifted by a cradle and passed out through rollers and wipers by which the scruf is removed from the surface.

The bath may be made double, so that two classes of work can be passed through at the same time.

A form of scouring or tinning bath is described which is circular in plan and has an annular platform supported upon rollers. The plates are supplied through openings in the top of

the bath, and while resting upon the annular platform, they are passed round by a lever, and on reaching the delivery position are delivered upwards through rollers. In place of the platform rotating it may be fixed, the plates being pushed along it by crossing them alternately.

A grease bath is also shown which can be rotated on a pivot and fitted with divisions to keep the plates separate.

For cleaning and dusting, the plate is inserted in the centre of a box which contains absorbing dust, thence it passes between wiping lips, and under the action of revolving and other brushes enclosed in a casing. After being brushed, the plate drops upon a wide travelling band.

[*Drawings.*]

A.D. 1879, May 15.—No. 1946.

STRAKER, Tooke.—(*Provisional protection only.*)—Manufacture of copper and nickel.

Ores etc. containing copper or nickel, or both, may be first smelted in a cupola or blast furnace, using cold or hot air blast and fluxes to obtain a product with a relatively high percentage of the metal. Afterwards the regulus is transferred or runs direct into an approximately rectangular concentrator furnace with an escape opening or chimney in or about the crown. Tuyères, at the sides and set at an angle, direct the blast on to the material on the hearth, which may be from 8 to 20 inches below the nose of the tuyères. The impurities in the regulus, chiefly sulphur, iron, and arsenic, are oxidized or volatilized out by the blast, sometimes aided by black oxide of copper, nitrate of soda, or other oxygen-yielding substance, siliceous material being used to form a fusible slag with the oxidized metals. Instead of having the carbon or like material in contact with the metal to be concentrated, only sufficient coke or other heating-agent is used to produce a high temperature at the early part of the operation; and afterwards the metal and other substances are kept liquid by the heat given off by the oxidation of the sulphur and iron, sometimes aided by purified blast-furnace gases or by other heating gases, which can be provided by passing a current of air through incandescent coke in a retort preferably close by.

The copper or nickel is afterwards refined in any usual way.

[*No Drawings.*]

A. D. 1879, May 20.—No 2004.

CROSSLEY, WILLIAM.—(*Letters Patent void for want of final Specification.*)—Materials for furnaces.

"A basic lining made of lime, limestone, magnesian lime-"stone, or magnesian limestone lime," or mixtures thereof, in combination with aluminate of soda or of potash, or both, may be used for furnaces, converters, or like apparatus for making iron and steel; and may be rammed to the shape of the furnace or moulded and burnt into bricks. The aluminate acts as a cementing material, and the intentional introduction of silica is dispensed with.

[*No Drawings.*]

A.D. 1879, May 20.—No. 2006.

SPENCE, JOHN BERGER.—Treatment of metallic sulphides.

All ores containing metallic sulphides, alone or with other substances, may be treated. All metallic sulphides, when reduced to an impalpable powder, are dissolved by sulphuric acid and converted into sulphates, the sulphides being preferably boiled in the acid. When concentrated acid is used, sulphurous acid is evolved. Again, sulphates may be produced by mixing the powdered sulphides with strong sulphuric acid to form a pasty mass, which is then heated in a retort. In these processes arsenic is evolved and suitably condensed.

When insoluble sulphates like sulphate of lead are formed, they may be treated and the soluble sulphates separated by known means.

The invention also relates to pigments and bye-products.

[*No Drawings.*]

A.D. 1879, May 22.—No. 2050.

BOLITHO, OTHO GLYNN.—(*Provisional protection only.*)—Separating ores &c.

The inventor employs casings, which form channels, having approximately the same breadth throughout but increasing in length from bottom to top, and which may comprise two like cones or pyramids one inside the other with vertical axes, so that by raising or lowering the inner cone the channel between them can be altered in breadth. The outer casing is truncated

and connected water-tight to a vertical chamber or tube, closed at the bottom, and supplied with water in its side or bottom by a pipe with a regulating stop-cock. Several casings side by side may debouch into one chamber, close to the bottom of which there is a discharge cock for the exit of the ores treated.

When water is admitted to the chamber it rises in the casing, its velocity uniformly diminishing as it rises, from the increasing size of the channel, until on reaching the top it flows quietly over the outer edge of the casing into a launder. All eddying is prevented as the rising water can flow laterally but in one direction. The ore enters the whole length of the channel at the top, and drops on to the surface of the water on the inner side of a strip, which extends all round the top of the channel to prevent the ore from flowing at once over the edge of the outer casing. The heavier particles will descend through the water to the discharge cock, while the lighter particles will, at varying depths according to their specific gravities, encounter such a current of water that they cannot descend lower, until its force is diminished by lessening the supply of water or by widening the channel. At intervals the supply of water is quite stopped to permit particles suspended by the last-used and weakest current to pass out at the bottom. By successively using currents diminishing in velocity, the ore can be separated into various classes.

At one or more levels in the casing there may be orifices of regulated size for the passage of water and, if desired, portions of the ore. In this case the length of the channel need not vary at different levels, since the escape of the water will diminish the current as it rises. Or pipes may project into the channel with small holes on their under sides. The apparatus may be struck by mallets as in some ore-dressing processes.

[*No Drawings.*]

A.D. 1879, May 23.—No. 2066.

LAKE, William Robert.—(*A communication from Jean Baptiste Theodore Despiau.*)—(*Provisional protection only.*)—Alloy resembling silver.

Equal parts of pure tin and brass are melted together, and then two parts of native antimony are added. This alloy is poured out and, when solid, pulverized.

Some ordinary tin is melted, and from 15 to 20 p. c. of the powder obtained as above described is mixed therewith, and 10 p. c. of bismuth is added. The resulting alloy may replace silver in the manufacture of metal goods; its composition may be slightly varied for different purposes.

[*No Drawings.*]

A.D. 1879, May 23.—No. 2069.

GREY, David.—Preparing metal plates for being coated.

Pickling and washing metal plates prior to coating with tin &c. The plates are placed on edge in an open carrier, suspended by chains from a traveller running on an elevated railway preferably endless. Above the pickling and washing tanks the railway has a movable part or lifter the vertical movement of which is controlled by stops. The lifter is suspended from chains passing over pulleys and carrying balance weights and may be raised and lowered by a chain operated by the piston rod of a steam or other cylinder. The carrier is loaded and moved on to the lifter above a tank which contains dilute acid. The lifter is operated so as to plunge the plates and carrier several times into the liquor and the lifter finally raised to the level of the railway. The first carrier is moved over a tank containing clean water and a second loaded carrier is moved on to the lifter above the acid tank. The lifter is again operated and the contents of the first carrier are washed and those of the second carrier pickled. The lifter is again raised, the first carrier is moved forward to have its contents discharged, the second to the washing-tank, and a third to the pickling-tank. The washed plates may be dried by passing them between india-rubber or other squeezing-rolls placed over the sorting-table. Plates which are to be tinned are after being "white "annealed" placed on edge in batches on a thin layer of sand and moved to and fro to assist the sand to penetrate between the plates, which are afterwards placed sanded-edge upwards on the carriers and pickled and washed as above described.

[*Drawing.*]

A.D. 1879, May 27.—No. 2101.

THOMPSON, William Phillips.—(*Provisional protection only.*)—Manufacture of metals.

In obtaining metals having a great affinity for oxygen, fluid

iron or alloy of iron may be used as a reducing agent, or to assist hydrogen or carbon as such. A modified Bessemer steel converter is employed. Aluminium may be made direct in a converter, placed on trunnions and divided below into two lobes, each capable of containing the charge. At the bottom of one lobe, which is lowest when the orifice of the converter faces a chimney, is the ordinary air blast. At the bottom of the other lobe, which is lowest when the orifice opens into a chamber, are tuyères or sets of tuyères, the streams from which quickly intermingle. One is for hydrogen or hydrocarbon gas, and the other for the chloride or fluoride (or a double chloride or fluoride) of the metal to be reduced. The fluid iron is first blown in the air lobe and, when a little heated, is poured into the other lobe, whereupon hydrogen or a hydrocarbon and one of the said compounds of aluminium (preferably in a melted or gaseous state) are forced in. The hydrogen transfers the chlorine or fluorine to the iron, and escapes into the chamber with the chloride or fluoride of iron, the latter being condensed and the former drawn off for use again. The carbon of the hydrocarbon and the aluminium remain behind. When beginning to cool, the mixture is turned into the blowing-lobe and the carbon oxidized ; it is then turned back and reduction proceeds. When most of the iron is used up, pure hydrogen is employed, and, after all the carbon is burnt off and the iron nearly used up, a portion of the alloy of iron and aluminium is poured out and a fresh charge of cast iron poured in ; this is preferable to changing the entire contents. The converter may be lined with a mixture of lime, magnesia, and alumina.

To obtain sodium is simpler : no hydrogen is used, and only enough carbon to act as fuel in reheating. Caustic soda is forced into the molten iron, the carbon of which takes up the oxygen, and the sodium escapes and is condensed in the chamber ; the iron can afterwards be recarburized or otherwise dealt with.

The process is less adapted for making potassium, great waste occurring.

To produce very pure aluminium, sodium must be made as described, and the chloride or fluoride of aluminium must be placed in the chamber, which is kept heated to maintain the flux of chloride or fluoride of sodium very liquid. The mass may be stirred to let the shots of aluminium agglomerate. The chamber is lined with calcined alumina or other basic or neutral

material, and should have a raised bed at one end to receive the aluminium salt. Again, this salt may be introduced in fine streams to better combine with the sodium vapour. Aluminium, formed in the converter, will require purifying from iron by nitre.

The process may be modified for producing calcium, magnesium, strontium, and barium.

A stationary hearth may be used in place of a converter, and the air and gases be heated in stoves.

[*No Drawings.*]

A.D. 1879, May 27.—No. 2110.

SIEMENS, CHARLES WILLIAM.—Producing heat by electricity.

The inventor refers to his prior Specification No. 4208, A.D. 1878, which relates to the cooling of the terminal of an electric lamp by a stream of water passed through a cavity in the terminal.

In applying an electric current to produce intense heat for the fusion of refractory substances, the inventor employs two carbon rods, fitted to slide towards each other horizontally through holes in the opposite sides of a crucible, made of highly-refractory material like lime or alumina, which may be water-cased if needful. The substance to be fused being placed in the crucible, the said rods are advanced near enough to each other to form a voltaic arc within the crucible. Each rod may be advanced by clockwork or other motor in proportion to its rate of consumption, so as to maintain the arc within the crucible. This advance may be checked, stopped, or reversed by the action of a thin metal strip or solenoid as in electric lamps described. As the heat in the crucible increases, the resistance to the arc within it lessens, so that the arc can be elongated; an effect which results from the automatic checking, stoppage, or reversal of the clockwork. The cover of the crucible may have apertures for admitting air or other gases to act on the substance under treatment. When this substance has sufficient conductivity, the terminals may be made of it instead of carbon.

In one arrangement, one terminal is a carbon and the other a metal pole, cooled by circulation of water in accordance with the prior invention. Either or both terminals may be tubular for introducing gases into the crucible to effect chemical

reactions. The terminals are pressed down upon grooved rollers by heavy upper rollers. The axes of the former carry worm-wheels gearing with worms on a spindle, which is made in two parts coupled between the terminals by insulating material. This spindle is the axis of a bladed wheel mounted within a casing, above which is a receptacle for sand or other heavy powder (or it might be liquid). Under the mouth of the receptacle is a funnel tube, which can oscillate on a pivot. A weighted lever arm projects from the funnel and is linked to an iron core, which works within a solenoid, having a coil of high resistance in a circuit connecting the line-wires of the terminals. A plate at the top of the funnel has two ports with a closed portion between them, and when the funnel stands upright, no sand can leave the receptacle. When the terminals are so far apart that little or no current can pass from one to the other, it will pass largely through the solenoid, and the core, being then attracted upwards, will cant the funnel, so as to bring one port under the receptacle and its own mouth to the right of the crown of the bladed wheel. Thereupon the sand will pass down the funnel and act on the right-hand blades, thus so revolving the wheel as to cause the terminals to approach each other. But when they are so near that little current passes through the solenoid, the core descends, canting the wheel towards the other side, so that the sand falls on the left-hand blades of the wheel thereby reversing its rotation and drawing the terminals apart.

When the material for treatment is a conductor, it (such as fused metal) may form one terminal and lie in the bottom of the crucible in contact with a screw or pin, which is faced with platinum or other metal not acted on by the metal for treatment. The other terminal is suspended through a hole in the crucible cover, and can be made to ascend or descend by the action of a solenoid or expanding metal wire or strip as in the lamps.

In electric lamps described, one terminal is fixed to the end of a lever, which works on a fulcrum on the framing, and is suspended by a long thin metal strip forming part of the lamp circuit. As the current passing through the circuit varies, the length of the strip varies, and the lever is made to oscillate, causing the terminals to approach or recede from one another. Or a solenoid may be used, its sliding core being attached to the lever of the terminal.

[*Drawings.*]

A.D. 1879, May 30.—No. 2156.

HICKMAN, Alfred.—Calcining kilns.

After describing the application to an iron-smelting blast furnace of internal vertical and preferably radial walls protected at the top by iron plates, it is stated that similar walls may be carried from the bottom to the top of a calcining kiln, thus dividing it into, say, four separate kilns in which different materials can be simultaneously and separately calcined. The filling-in openings are arranged to suit the division walls, which may be sometimes carried on arches any desired height from the bottom of the kiln. Thus, pulverization of the contents of the kiln is checked, as well as its liability to choke; and, if choking occurs, it is more easily dealt with.

[*No Drawings.*]

A.D. 1879, June 3.—No. 2203.

LAKE, William Robert.—(*A communication from Charles Eugene Ball.*)—(*Provisional protection only.*)—Amalgamating ores.

The comminuted ore is made to ascend through a column of mercury, above which the air is exhausted, so that it becomes supported by the atmospheric pressure at its base. The amalgamation may take place in a U-shaped tube, the second arm of which rises at least 77 centimetres above the bend and is surmounted by a steam jet or equivalent for exhausting the air and discharging the residuum of ore. Mercury, being placed in the tube, will, on exhausting the air, rise into the second arm to a height due to the atmospheric pressure on the base of the column. The ore mixed with water is now admitted from a hopper into the first arm, and, on reaching the exposed lower surface of the column of mercury in the second arm, passes into and up through the mercury and is discharged above the same, complete amalgamation of the metal in the ore being produced during its transit through the mercury. The exhaust of air, produced by a jet, air pump, siphon, or equivalent, facilitates the transit of the ore and aids the amalgamation.

[*No Drawings.*]

A.D. 1879, June 4.—No. 2207.

THOMPSON, William Phillips.—(*A communication from Georg Fischer.*)—Crucible furnaces.

The middle part or melting-chamber of the furnace is

suspended by two axles, formed hollow for watching the process through them, and turning in bearings on pillow blocks, which are placed on the upper floor of the melting room. This chamber is a strong iron cylinder lined with refactory material, which is clasped by angle-iron rings. The tuyères are gutter-shaped, arranged inside the lining, and occupy the whole length of the chamber. Each tuyère is divided into two equal lengths, the lower one serving at each time as a tuyère or blast pipe, while the upper one is kept in reserve until it is necessary to tilt the melting chamber on its axles. The tuyères are perforated with holes, through which the air passes into the chamber. The furnace has a movable upper part or dome-shaped metal cap with a top funnel. The lower part of the furnace comprises a cylindrical air chamber, divided into an upper and a lower chamber by a perforated wind sieve to regulate the distribution of the wind, and covered by a perforated melting or grate plate, whereon the crucibles rest upon stands. Through the melting-plate passes a central tuyère, provided with side holes and serving as a stand to the central crucible, which may be placed somewhat higher than the others. The latter are so arranged concentrically as to leave room for the requisite fuel, the thorough combustion of which, without excess of air, is an object. The air enters the air chamber through pipes, cut obliquely and flanged for connection with the blast pipes. A jacket at the edge of the melting-plate surrounds the lower part of the melting chamber, protecting it from loss of heat and retaining the fuel and crucibles. The diameter of the air chamber is rather less than that of the melting-chamber, so that an annular space of the melting plate remains free, from which heat may radiate to cool the plate. The lower part of the furnace is raised into connection with the melting chamber by an elevator, comprising a supporting platform, vertical posts serving as guides, a hand wheel, shaft pinions, and toothed racks, a counterweight being fixed to a chain or rope which passes over a pulley. This part is likewise let down upon a track on the floor of the melting-house for conveying away the molten material. Thus also another lower part, heated and charged with crucibles, may be brought and raised up to the melting-chamber while the latter is highly heated. There is a device for holding up the said lower part in connection with the melting-chamber, so that the platform

may be lowered. An automatic wind regulator, comprising a prismatic tube and a hinged and adjustably-loaded plate, controls the wind pressure employed. Again, an hydraulic or other elevator worked by a prime mover may be used.

[*Drawing.*]

A.D. 1879, June 5.—No. 2227.

AITKEN, RUSSEL.—Extracting gases from molten metals.

To improve the qualities of metals and produce them of a close homogeneous character by the extraction of occluded gases, the ladle, trough, crucible, or other vessel containing the molten metal for treatment is hermetically closed by a cover, and a vacuum is produced over the metal, as by a communicating air pump, whereupon the gases will expand and almost wholly leave the metal. Again, the containing-vessel may be enclosed in a chamber wherein a vacuum is produced. Or chambers, in which metals are heated or melted, may be subsequently made airtight and exhaustion applied thereto. Also molten metal may be run through a siphon, having legs of sufficient length "to give the required vacuum at the top or bend of the "syphon;" where the disengaged gases are drawn off by an air pump or otherwise.

"To cast certain articles in vacuo" is not claimed.

[*No Drawings.*]

A.D. 1879, June 14.—No. 2361.

ALTHANS, ERNST FRIEDRICH.—Refactory materials.

Finely-powdered limestone, marble, chalk, dolomitic limestone, or dolomite, as free as possible from silicic acid, alumina, iron oxide, etc., is mixed and kneaded to a plastic state with a solution of magnesium chloride, which acts as a binding and hardening substance. The mass is used either burnt or preferably unburnt as a refractory material. Bricks, tiles, crucibles, and other metallurgical apparatus may be made. Furnaces or Bessemer converters may be lined or repaired, the plastic mass being applied in layers, stamped, slowly dried, and gradually heated up. Slow drying at 280° to 300° Fahr. produces hardness. The mixture, thinned down with water, can be used as a mortar. The dolomite should only contain a small admixture of magnesium carbonate,

or unburnt limestone should be added. To pure limestone can be added dolomite, magnesite, or artificial magnesium carbonate. The addition of burnt limestone, dolomite, or magnesite is not recommended. Again, calcium chloride or hydrochloric acid, separately or together, may partly or wholly replace magnesium chloride, if the proportion of magnesium carbonate be correspondingly increased. As the chlorine compounds of aluminium, iron, and manganese on heating with limestone or dolomite produce calcium or magnesium chlorides, while the separated bases do not materially impair refractoriness; and, as the alkaline chlorides in many ways replace chlorides of the alkaline earths, these chlorine compounds might be also used (especially the alkaline chlorides, when desired, to soften the material in the fire).

[*No Drawings.*]

A.D. 1879, June 18.—No. 2411.

LEYSHON, George.—(*Provisional protection only.*)—Manufacture of tin and terne plates and galvanized sheets.

After a sheet has been passed through a pair of plain rolls wetted with acid, it is carried by endless chains through a furnace, where it is heated and annealed, and is then delivered through a pair of rolls corrugated lengthwise, which crimp the sheet and thus remove the surface scale. Subsequently a pair of plain rolls flatten the sheet and give a surface thereto. For tin and terne plates, ordinary planishing rolls and the usual annealing are afterwards employed.

[*No Drawings.*]

A.D. 1879, June 19.—No. 2431.

KESSELER, Carl.—(*A communication from Albert Wegelin, Ernst Hübner, and Emil Pollacsek.*)—Extraction of metals from residues of pyrites or other minerals used in the manufacture of sulphuric acid or sulphur.

Reference is made to the prior Specification No. 5066, A.D. 1878.

Metals, such as copper, zinc, and silver, may be extracted from roasted pyrites and blende by ammonia or carbonate of ammonia at a temperature not exceeding 45° Cent.; after

which the copper and silver are precipitated from the resulting solution by zinc. The zinc extracted from the roasted mineral, as well as that dissolved in the said precipitation is then precipitated and recovered as a sub-carbonate or hydrated oxide by distilling the ammoniacal solution with superheated steam. The ammonia and carbonic acid are regenerated in accordance with the prior Specification, and the appliances used for this process are substantially in accordance with the same Specification, excepting the precipitating-vessels, which may be constructed of wood or wood lined with lead.

[*No Drawings.*]

A.D. 1879, June 23.—No. 2510.

GRAVELL, JOHN.—(*Provisional protection only.*)—Tin and terne plates.

The apparatus is divided into a series of compartments or chambers for the successive operations, and each of these is provided with a wire grate to keep the plates upright and at equal distances apart. The plates are placed in a similar grate, a frame carrying a series of spring tongs capable of taking hold of the plates is applied over them, and they are lifted successively into the pickling, the cleansing, the oiling, and the tinning chambers. Over the tinning-chamber is applied a frame connected to a rack, and resting with its lower edge in the oil above the molten metal, so as to act as a skimmer. It has an opening through it for the passage of a sheet of metal, and as the operator removes one plate through it, he places another in the grate; and so on, as he moves the frame step by step. The plates are brushed by passing the plates downwards between covered rollers to rubbers covered with hemp, whence they are conducted to the dipping-pot and finishing-rolls.

[*No Drawings.*]

A.D. 1879, June 27.—No. 2594.

COVENTRY, MILLIS, the younger, and WILKS, MATTHEW.—Metallurgical processes.

The claims of this Specification, which is a development of the prior Specification No. 1046, A.D. 1879, extend to the employment of apparatus described below for impregnating an

air blast with vaporized hydrocarbon oil or spirit, when used in combination with vessels, chambers, or furnaces, " in which " metals or their ores are being treated in a molten state."

Above the blast pipe leading to a converter for making steel there is fixed a tank of petroleum or other hydrocarbon, which passes to the main blast pipe along a horizontal pipe, the latter being externally heated (as by steam or hot air) in order to vaporize the hydrocarbon, which is then carried forward into the blast pipe and thence by the blast into the metal under treatment. A small pipe to equalize pressure connects the blast pipe with the top of the tank. If a hot blast be used, it will vaporize the hydrocarbon when introduced into the blast pipe in the form of spray through a rose or perforated disc. Means are provided for regulating the supply of the hydrocarbon, and consequently the amount of heat generated thereby in the molten metal.

[*Drawing.*]

A.D. 1879, July 12.—No. 2852.

LAKE, William Robert.—(*A communication from William Henry Brown.*)—Improvements in and relating to steam and other boilers, and partly applicable to vessels used in distilling or similar operations, or for containing mineral waters or other fluids.

Part of the invention described relates to coating metal plates, which are to be pressed and drawn into cylinders, with tin, copper, or some similar metal, which may act as a lubricant during the operation and as a preservative from oxidation afterwards. The coating may take place between the stages of the drawing process. Tin may be applied in the ordinary way, but if copper is used it may be deposited by means of a battery.

[*Drawing.*]

A.D. 1879, July 25.—No. 3030.

NEW, Alfred James, and THOMAS, Samuel.—(*A communication from David Thomas.*) — Heating and puddling furnaces, and refractory materials.

To utilize the waste heat, the products of combustion from a

heating-furnace may be led into a hot-air chamber, containing " breeches pipes," the lower ends of the legs of which are stepped into sockets so as to form a continuous communication between them. The said products surround and highly heat the pipes, through which air is driven by a blowing-machine and, thereby becoming highly heated, passes to the furnace. Thus the fire is fed with hot air, the doors of the ashpit being ordinarily closed. The said products afterwards ascend into the chimney, at the base of which is the said chamber. Columns carry an upper bed-plate on which the chimney is built, while side plates enclose and strengthen the lining of the hot-air chamber. In the case of a puddling-furnace, the hot-air chamber itself is carried on columns, and its crown conforms to the curve of the breeches pipes, which are placed in a separate outside chamber. The heated air is conveyed to boxes and thence into the furnace by horizontal conduits, so that it " mixes with the gases arising from the combustion of the " fuel," whereby the temperature is greatly raised.

Drawings show a heating-furnace with two firegrates on one side of the hearth and four descending outlet flues on the other, and a puddling-furnace with apparently a door opposite to the firegrate.

A mixture of ground flint and fireclay, preferably about $\frac{4}{5}$ of flint to $\frac{1}{5}$ of fireclay is applicable to different purposes, including the manufacture of crucibles and furnaces or ordinary firebricks or lining.

[*Drawings.*]

A.D. 1879, July 30.—No. 3095.

ROGERS, John Henry.—Pickling iron plates.

The pickling and washing tanks are provided with an oscillating system of paddles which is actuated from an eccentric. The plates are placed in a rack mounted on wheels, and the rack is, by suitable steam or hydraulic gearing, lowered into the tank, the pickling being then facilitated by the oscillating paddles. When the pickling is completed the rack is raised and transferred to a water tank, from which after washing it is removed and the plates are sorted over.

[*Drawing.*]

A.D. 1879, August 5.—No. 3152.

CLARK, Alexander Melville.—(*A communication from Sarmiento Ferdinand Louis.*)—Finishing zinc-coated wire.

The wire on emerging from the melted zinc or galvanizing-bath is drawn through slots in the sides of a chamber, which is packed with asbestos or a similar substance, compressed by a plunger fitting in the chamber, and actuated by a cam lever. Oil or other lubricant is supplied to the chamber from a raised oil vessel with a regulating-cock, from which it rises into the asbestos or other substance employed.

[*Drawing.*]

A.D. 1879, August 6.—No. 3157.

MATTHEWS, Isaac.—Coating metallic plates or sheets with tin etc.

The molten metal is contained in an annular trough or pot. A pivot situated at the centre of the pot carries a series of radial arms, fitted at the ends with racks or supports for the plates. These racks consist of bars bent into the required form, each being adjustable. The apparatus being in rotation, a plate is dropped from the feed box into the metal so that it rests upon two contiguous racks, suitable guides ensuring that it shall take up the right position. It is then carried round by the rotating arms, till it comes under rollers working in a grease box, at which position the plate is by the action of an inclined plane raised from the racks, so that it is engaged by the rollers. The plate thus raised passes out between the rolls and between metal wire brushes or, preferably, copper plates placed at an angle to each other with their edges in contact. In coating terne plates, two springs may be attached to opposite sides of the rack so as to hold the plates in position.

[*Drawing.*]

A.D. 1879, August 6.—No. 3168.

COVENTRY, Millis, the younger, and WILKS, Matthew.—Metallurgical processes.

Reference is made to the prior Specifications Nos. 1046 and 594, A.D. 1879.

The inventors claim their "improved method of treating

" metallic ores and metals by employing a blast of air impreg-
" nated with petroleum vapour or a combination of blast with
" petroleum vapour, the petroleum used being vapourized either
" before it enters the blast pipe or during its progress from the
" point of entry into such blast pipe to the vessel containing
" the metal under treatment." Apparatus, to which the secondly-mentioned prior Specification relates, may be employed for introducing petroleum or other hydrocarbon vapour into the blast; or by using a hot blast, hydrocarbon spray may be vaporized after introduction into the blast.

The impregnated blast is introduced into melting or molten metal to raise or maintain the heat thereof, when metals or ores (including not only ferruginous but cupreous and other metals and ores which are melted and treated in an analogous manner) are melted or treated in a furnace, chamber, or vessel, the quantity of hydrocarbon employed being regulated according to the amount of heat to be generated thereby in the metal. Tin ores may be treated.

[*No Drawings.*]

A.D. 1879, August 8.—No. 3190.

GUSSANDER, Axel Frithiof.—Mechanical separation and roasting of minerals.

To separate ores from mechanically-mixed impurities, the powdered (and sometimes previously roasted or burnt) ore is introduced through a narrow fissure and falls continuously in measured quantities into a current of air proceeding from the mouth of a tube. The air carries forward the particles, which become deposited in a room (protected from disturbing air currents) in the order of their respective specific weights, the heavier and richer components falling first, and the lighter ones further off. Moveable or fixed partitions are fitted where required to collect the falling powder. To get a more complete separation, one or more air currents may be introduced below and parallel to the first. Sometimes the powder may be fed through an inner tube inserted in the air tube. The air current may be produced by a blowing-machine or by a chimney draught.

Impurities of equal specific weight to the ore may be

separated from the latter by a magnetic separator, provided the ore mixture contains a magnetic component, or the ore has been rendered magnetic by oxidation or reduction. Thus, the powder may be blown against magnetic iron plates, placed behind each other and moved to and fro, the powder adhering to the plates being scraped off when they are removed from the air current.

If an ore contains "sulphuric minerals," it may be treated in a roasting furnace, which preferably consists of a hollow cylinder, placed lengthwise (or upright), and constructed of plates, firebricks, etc. It may be heated externally, or internally if the products of combustion be oxidizing. In this furnace a hollow screw rotates, having holes for blowing cold or heated air into the furnace. The ore powder is continuously introduced, and is propelled forward by the screw, which may have scrapers or shovels to carry the ore upwards and let it fall again. Sometimes the air may be otherwise introduced, as through the gable or end of the furnace. The roasted powder may fall into a storing-compartment, or into a reducing-furnace the invention also relating to the reduction of iron ores.

[*Drawing.*]

A.D. 1879, August 13.—No. 3271.

SIMON, Henry.—(*A communication from George Leuffgen.*)—Melting glass, metals, etc.

Metals may be melted within a firm crust of the same metal as is being melted, such crust being produced by cooling from the exterior, while the heat of the melting fire is caused to act or work in from above only.

The melting of glass is described. The burning of the gases employed and generation of heat may take place under the roof of the furnace, and beneath the roof is a melting-chamber containing a melting-vessel or hearth, into which the heating flames play. The vessel may have a double bottom and walls, and air, water, steam free from pressure, or other substance may be made to circulate through the intermediate spaces: or the vessel may be placed within a chamber, through which water or other substance flows. Thus the cooling of the wall of the vessel and of the said crust is effected. And as the material being melted rests on a crust of the same material at the sides

and below, it does not take up impurities from the melting vessel or its lining. The vessel is provided with supply and outflow pipes etc. for the cooling-agent.

The invention also relates to casting glass etc.

[*Drawings.*]

A.D. 1879, August 18.—No. 3324.

LAKE, William Robert.—(*A communication from the Gutehoffnüngshutte Actien-Verein für Bergbau und Hütten-betrieb and Reiner Maria Daelen.*—(*Provisional protection only.*)—Increasing the heat of reverberatory furnaces and Bessemer converters.

To introduce a considerable amount of heat while avoiding the nitrogen present in heated air ; the invention "comprises "the application of a suitable fuel mixed with suitable sub-"stances, such as salt-petre, manganese, or the like, which "deliver a considerable amount of oxygen and have a brisk "combustion, while but a comparatively small quantity of air "is admitted."

To the side of the reverberatory furnace or converter is secured an intercommunicating cylinder, so arranged that "the "gases and fluid slags coming from the said cylinder must pass "through the molten iron and ores to arrive at the surface." The top of the cylinder has a valve to allow the filling-in of the fuel, and a pipe to admit the blast.

[*No Drawings.*]

A.D. 1879, August 22.—No. 3386.

ALEXANDER, Edwin Powley.—(*A communication from Nicholas Yagn.*)—Intercepting the heat radiated from furnaces etc.

To protect workmen where considerable heat is radiated, as from puddling, heating, or other furnaces, refrigerating-screens of linen, cotton, or like fibrous substances, woven or otherwise, and cooled by water, may be used, or else sheets or strips of cardboard, paper, wood, metal, etc. The screens may be movable vertically or horizontally ; in the former case small screens may be raised to give access to the furnace doors. Cold water from

a perforated pipe constantly flows down the screens, so as to keep their surfaces moistened or saturated.

[*Drawing.*]

A.D. 1879, August 23.—No. 3402.

DEBY, JULIEN.—(*Provisional protection only.*)—Eliminating phosphorus from iron, other metals, and their alloys.

Phosphorus or its compounds may be eliminated through the action of gases in a Bessemer converter, blast or other furnace, receiver, or cupola. The elimination is effected by blowing through the molten metals, in temporary substitution for the atmospheric blast, a blast containing carbonic oxide, ammoniacal vapours, or some other reducing gas, specially made or obtained as a waste product.

[*No Drawings.*]

A.D. 1879, August 28.—No. 3461.

DALTON, GEORGE.—Breaking or crushing stone etc.

To improve a Blake's stone-breaker, the oscillating or moveable jaw may be operated by mounting it upon a cam or eccentric fast on the actuating shaft, whereby the jaw receives a rising and falling curvilinear motion. Toggles, to give a lateral thrust to the jaw during its downward motion so as to produce the required crushing action, extend between the back of the jaw and an adjustable sliding piece or wedge, connected by a screw and nut to the frame of the machine, the jaw being drawn back, after moving forward, by a spring connection. The toggle block is adapted to guides in the frame, and is slid outwards or inwards by raising or lowering the wedge, so as to vary the lateral throw of the jaw according to the fineness of crushing required. The crushing-strain is sustained by the toggles and frame, and not by the actuating shaft.

[*Drawing.*]

A.D. 1879, August 29.—No. 3478.

DAY, CHARLES AUBREY.—Puddling, heating, and reducing furnaces.

To intensify the heat of the furnace, air under pressure may traverse a pipe which passes first through the bridge wall, thence through the edge of the recess in the bed, next through

its rear wall, and ends in a chamber beneath the bed, the pipe being built into the brickwork. The air is further heated by exposure to the under side of the bed, and enters the ash-pit, whereupon part of it is used for combustion of the fuel in the grate. The rest ascends through vertical pipes, built in the side and end walls of the fire-place, into a chamber above the latter, and then passes in a highly heated state through inclined orifices (or a transverse slot) in the roof of the furnace, whereby it is directed on to the bed of the furnace beyond the bridge, and ignites the unconsumed gases from the fire-place, aiding the products of combustion in performing their duties. Thus also the walls of the fireplace are strengthened, and their rapid burning away is prevented. A perforated steam-pipe passes along the side of the fireplace at the edges of the grate, and supplies steam to cool the wall and promote combustion.

[*Drawings.*]

A.D. 1879, August 30.—No. 3489.

ALTHANS, Ernst Friedrich.—Basic refractory materials for metallurgical purposes.

The inventor uses caustic alkalies or their carbonates, or chlorides of alkalies or of alkaline earths, with or without the addition of fluorspar or cryolite, as binding-ingredients for a refractory material, having for its body finely ground limestone, marble, chalk, or like substances or mixtures thereof, as free as possible from silica, alumina, metallic oxides, etc. The mixture is moistened and used in a plastic state directly as a lining for furnaces or as a cement, or is formed into bricks, slabs, crucibles, or other receptacles and dried, being gradually warmed and then heated up before use. The material becomes hard on firing.

[*No Drawings.*]

A.D. 1879, September 3.—No. 3528.

FOSTER, Herbert Le Neve.—(*Provisional protection only.*)—Treating metal bars, plates, and sheets.

To remove scale or oxide from the surfaces of different metals and to anneal or soften the metal, the inventor passes carbonic oxide, cyanogen, sulphuretted hydrogen, hydrogen, carburetted hydrogen, or any compound of carbon and

hydrogen in a gaseous or other form, or a mixture thereof, over the metal, enclosed in an airtight vessel sufficiently heated to reduce the scale or oxide to a metallic state.

[*No Drawings.*]

A.D. 1879, September 6.—No. 3581.

GLASER, Friedrich Carl.—(*A communication from Theodor Fleitmann.*)—Alloys of nickel with zinc.

By reducing combined oxides of nickel and zinc, metallic nickel may be obtained containing as much as 10 p. c. of zinc, only part of this metal being evaporated. Even at the melting-point of nickel, there remains 5 p. c. or more of zinc, and the nickel acquires important toughness and density ; it yields, with an addition of one-tenth p. c. of magnesium, a very tough and ductile metal, having otherwise the properties of pure nickel. To produce the alloys, mixed solutions of nickel and zinc may be jointly precipitated by means of an alkali or other base, and the mixture of oxides obtained is purified and heated as usual for the manufacture of nickel ; or the combined oxides obtained by heating mixtures of compounds of both metals, such as the sulphate, oxalate, or carbonate, may be treated. Or a mixture of the purified oxides of nickel and zinc may be reduced to the metallic state. Or slightly reduced and pulverized nickel oxide may be mixed and heated with zinc oxide and a reducing agent, the nascent zinc vapour combining with the finely divided nickel. Or vapours of zinc may be introduced among spongy reduced nickel while being heated to melting-point. The product yields, with rapid melting, alloys which give tough castings and can be rolled or drawn into plates or wire cold or hot.

[*No Drawings.*]

A.D. 1879, September 6.—No. 3586.

LAMBOTTE-DOUCET, Alfred.—Treating copper, lead, and zinc ores, cinders from working in the precious metals, residue from retorts of zinc furnaces, schlams, and zinciferous and argentiferous fumes, and extracting silver from copper and lead ores.

In treating copper, lead, and zinc sulphides (or oxides), the ore, powdered and moistened with sulphydric acid (hydrogéne

sulphuré), is introduced into a reverberatory furnace containing a muffle, or into some other vessel connected with condensation chambers. It is warmed to a dull red in a current of chlorhydric acid ("dishydrated" or "hydraté") under pressure, the metals being converted into chlorides, and the sulphur of the ores into sulphydric acid which passes off. Afterwards the temperature is raised, and a current of air is directed into the retort (furnace) to aid in volatilizing the chlorides which are condensed in the said chambers, whereinto water is introduced in the shape of rain. The metallic chlorides in solution, obtained by the above or other method, are decomposed by thermo-electric currents, which liberate at the positive pole of the battery the chlorine (to be collected), and at the negative the metal (to accumulate there). The currents are generated by means of the superfluous heat of the furnaces etc., acting in closed circuits, which are composed either of one metal or of two different metals, formed into bundles (strands) of large wires and twisted together and greatly compressed to form a metallic rope. The ends of the circuit are joined and closed by a plate of soft iron magnetized. Other good conductors, such as peroxide of manganese, sulphides of iron, lead, copper, etc. may be also used to produce the currents. Each closed circuit forms an element: several elements form a thermo-electric battery. The elements are grouped in series, ranged vertically side by side and jointed together by large copper wires; so that the last bismuth (for instance) of a series is joined by a twist and even slight fusion to the antimony of the next series. The elements forming a battery have a metallic enclosure (with a light lining not easily melted), into which the superfluous heat from a furnace penetrates, while all the exterior is acted on by a current of air cooled to about freezing point by a refrigerating mass. The extremes of temperature and the permanent magnetization of the soft iron coverings intensify the electric effect.

In treating silver-producing sulphide of lead and sulphide of copper, the ore is melted with a flux of carbonate of soda and of potash, charcoal, and nitrate of potash. The carbon must be in excess, so that the sulphosalts and the sulphates produced may be decomposed into metal and alkaline sulphides, which increase the fluidity of the mass and preserve the fused metal from oxidation, and which are easily separated from the metallic

lead by lixiviation and their constituent parts used again. The lead is run into warmed crucibles (like those used in extracting silver from lead by crystallization), and zincate of soda is added. The temperature is raised to 540° Cent., and after stirring to ensure complete mixture, copper wires furnished with copper handles in communication with the poles of a thermo-electric pile are introduced into the molten mass, the zincate being decomposed and the zinc and soda set free. Afterwards the temperature is lowered to 430° Cent., and an alloy of zinc and silver solidifies. The soda completes the purification of the lead. On distilling the said alloy in a retort, the zinc volatilizes and the silver remains : it is melted and cast.

Alloys in variable proportions of copper, lead, and antimony are formed by precipitating with zinc or iron a solution of these metals in the presence of the gold and silver contained in the crushed ore or cinders from metal working for treatment. By melting the alloys in a fusible bath of hydrate or carbonate of soda and of potash, a cast of lead, copper, and antimony is obtained, wherein is concentrated all the gold and silver in the matters treated.

[*No Drawings.*]

A.D. 1879, September 9.—3615.

JENKINS, James.—Cleansing tin and terne plates.

The apparatus consists essentially of a bran box and two pairs of rollers. The plates are fed into the apparatus by an endless adjustable band, being held in a nearly vertical position by stops. As each plate reaches the rollers it is lifted by them and passes through the bran box. The rollers rotate and at the same time receive a rapid longitudinal reciprocating motion by a crank &c., so that as the plate passes into the bran in the box it is rapidly moved laterally. The plate is then taken by the delivery rollers, on issuing from which it may be dusted by means of sheepskin dusters.

[*Drawing.*]

A.D. 1879, September 9.—No. 3619.

WHITEHOUSE, Daniel.—Manufacture of tin, terne, and similar plates.

The pickling-tank and the swilling-tank are sunk beneath the

ground level. Each is provided with a cage or platform, which can be raised or lowered by any suitable crane, so arranged that when it is up out of the tank, the platform joins part of a line of tramway which is provided with turntables. The plates are placed in a crate or frame somewhat similar to that described in Specification No. 1358, A.D. 1877 ; the end pieces are frames of metal wider at the top than at the bottom, so that the lower parts of the frames slope inwards, intermediate ribs being similarly shaped, and the whole is held together by suitable bars.

The crate is provided with wheels which run on the tramway. A crate being loaded, it is run upon the platform, dipped into the pickling-tank, raised, run upon the second platform, dipped into the swilling-tank, raised, and run away along the tramway. Two cages of plates, one for the pickling-tank and one for the swilling-tank, may be worked simultaneously. The plates in the tank are kept in motion by the action of rotating cams, driven by gearing within the tank.

The tinning-pot is semicircular in vertical cross-section, and is provided with a cylindrical frame the lower half of which fits into the pot, leaving a space between through which the plates pass to be coated. Around the outer periphery of the frame is an annular band of metal, provided with arms or projections and running on rollers. Attached to the frame are also two guide-pieces grooved to receive the plates. The attendant puts a plate in the groove at the entering position, one of the projections on the annular band pushes it forward through the bath of molten metal, and another plate is put in in time to be caught by the next projection, so that several plates are passing through at once. At the delivery end of the pot are rollers between which the plates are passed. Instead of the plates sliding along grooves they may be attached to the band.

The plates are greased, preparatory to tinning, by passing through a vessel furnished with felt-covered rollers working in grease.

[*Drawings.*]

A.D. 1879, September 12.—No. 3654.

VON NAWROCKI, GERARD WENZESLAUS.—(*A communication from Gustav Ibrügger.*)—Furnaces.

Below the melting-chamber of a cupola furnace, which has

an intercommunicating channel or opening in its bottom, there is a preferably oblong chamber wherein metal may be melted.

This lower chamber has an arched roof, an opening for charging and for observing and stirring the metal, a tapping-hole (towards which the bed slopes), and at the opposite side (preferably made removable to give access for repairs) a hole for drawing off slag. On igniting fuel in the cupola chamber, the gaseous products pass into the lower chamber, where the combustible particles are burnt by a blast of air introduced through a pipe, to produce intense heat for fusing the metal therein. Metal is also melted in the cupola chamber (the top of which is more or less closed) and, flowing down into the lower chamber, mixes rapidly with the comparatively-thin layer of metal melted therein.

The cupola chamber has two rows of tuyères or blast-holes with narrow vertical oblong inner orifices to prevent slag from choking them. The lower chamber may be separate from the cupola and mounted on wheels for removal, and it may be simply used for keeping molten metal highly heated until it is run off.

[*Drawing.*]

A.D. 1879, September 15.—No. 3695.

MADGE, Charles.—Retorts, muffles, and pots for reducing zinc and other ores, with means of protection from the destructive action of heat and slag or ore.

Reference is made to the prior Specifications No. 1113, A.D. 1870, and No. 1092, A.D. 1871, which relate to retorts etc. with air passages formed in the floor etc., and having openings into the furnace.

The present inventor ensures a circulation of cooling air through the floor, walls, and roof of the retorts etc., or through either of such parts (without discharging such air into the furnace employed) by forming in the thickness of the floor, walls, and roof, one or more sets of forward and return passages, connected in pairs by transverse passages. One end of the coupled passages is open to the atmosphere, and the other or return end is connected to a special flue for carrying off the air which has become heated in passing through the passages.

Sometimes air may be forced through the passages by a pump or blower.

[*Drawing.*]

A.D. 1879, September 16.—No. 3716.

HUGHES, EDWARD THOMAS.—(*A communication from the Blake Crusher Co.*)—Stone-crushers.

A three-sided cast-iron or steel framework with broad flanged base, resting upon thin elastic cushions and fixed upon two parallel supporting timbers, forms the front and two sides of the jaw-opening, and supports the suspending-shaft of the movable jaw. Wrought-iron or steel clamps, on each side of the jaw-opening, take part of the strain, hold the said shaft in position, and form part of the walls of the opening. An iron or steel casting, forming the back of the machine or "toggle "block," is supported like the front casting or framework. Main tension rods pass through and connect the two castings, and have screw threads and nuts, or equivalents, for adjusting the position of the toggle block. The vibratory motion of the said jaw is derived from the toggle or elbow joint between the back of the jaw and the toggle block. A main shaft revolves in bearings bolted to the under side of the said timbers, the toggle joint being worked by an eccentric or crank through a pitman. The pitman comprises a block, in which the eccentric works, and into which are fixed one or more wrought-iron or steel rods, the latter passing through holes in the pitman head, above which are nuts to hold the head block in position. Spiral springs on the rods cause the pitman head to follow when the nuts are unscrewed to adjust the length of the pitman ; or other nuts may be used. The toggle joint works only on one side of a line joining the toggle bearings in the jaw and in the toggle block respectively. By means of the adjustable pitman head (which varies the inclination of the toggles), the length of stroke of the movable jaw can be regulated (according to a calculation given) within working limits without the substitution of parts, and the opening at the bottom of the jaws is adjusted by screwing up or unscrewing the nuts on the tension rods. The parallel timbers may be regarded as inverted beams, in which the front and back castings form the points of support, and the strain upon the pitman is the load ; they act as springs, and also

yield by compression of fibres, under undue strain. An elastic beam or girder of wrought iron may replace them. Instead of placing cushions on the supporting timbers or beams, the main-shaft boxes under the beams or the pitman head block may be cushioned. To support the toggle against twisting strain, the "toggle bearing" is constructed with a sleeve, extending therefrom on to the pitman rod, and taking a bearing upon the rod above the toggle bearing : the latter is adjustable on the pitman The movable jaw is withdrawn by a rubber spring on a rod, which passes through a transverse timber.

[*Drawings.*]

A.D. 1879, September 26.—No. 3882.

MOREWOOD, Edmund.—Coating metals.

This invention relates to a machine for coating metals as in the manufacture of tin and terne plates, reference being made to Specification No. 123, A.D. 1863.

The apparatus consists of a pot with a curved bottom and flat ends to contain the tin, the pot being fitted with hollow barriers which confine the metal at the exit end to a narrow cooling-channel. The pot is heated in the ordinary way by a fire near the entrance end, and for heating up the apparatus the hot air from the fire may be made to circulate through the hollow barriers and through flues ; afterwards cold air or water may be circulated. At the exit end of the pot is the grease compartment. This is fitted with several pairs of rollers which are driven by suitable gearing. The compartment is continued downwards so as to form a sort of pocket in which drippings from the plate, and impurities from the grease can collect. The grease compartment is also extended some distance at each end of the working surface of the rollers. Underneath the two uppermost pairs of rollers troughs are arranged to contain melted tin, in which the said rollers work.

The plates to be tinned are fixed in carriers, which oscillate about a horizontal axis, and carry the plates through the bath until they are gripped by the delivery rollers. The carriers consist of two grids made of light-rods attached together, and slightly curved, so that the plate on being put in is pressed against them, and is thus held in place. After a plate has been

removed from the carrier by the action of the delivery rollers, the carrier is returned by a balance weight, to be recharged. The pot may be sufficiently wide to allow three carriers being used side by side. Instead of the rocking arms, the carriers may be attached by pivots to an endless band.

The axis of one roller of each pair of rollers in the grease pot may be driven through a crank arm from a rod, which receives vertical and lateral movements from two driving-cranks on separate axes ; or the neck of one roller of each pair is prolonged through the end of the grease compartment, and carries worm wheels which gear with worms on an upright driving axis. These worms are mounted so that they can slide on the driving-shaft, which however carries them round by a feather or like arrangement, strong springs being used to keep the worm in its place.

[*Drawings.*]

A.D. 1879, October 1.—No. 3943.

GUTENSOHN, Adolph.—Galvanic generators ; and obtaining tin.

The description would appear to include obtaining tin for melting by reducing solid compounds of tin by electric action without necessarily involving electrodeposition. "The sulphate, " nitrate, chloride, or chromate of tin, either in solution or " otherwise, is used in the cell or chamber containing the " opposite pole to the zinc. For the other pole any of the " ordinary ingredients or chemicals may be employed. The " residue or deposit, arising from the electrical action" generated in the cell, " adheres in large quantities to the pole immersed " in the solution and is pure crystalline tin ; which may be " collected and reduced to ingots," etc., by melting. "Where " the solution be employed it must be of considerable strength" to obtain crystalline (and not spongy) tin ; " and where the " salt alone be used it must be damped." The crystalline tin may be re-dissolved by electric action for recharging the battery ; or tin waste, crude or refined tin, tin ore, or the waste residue of tin mines may be used.

[*Drawing.*]

A.D. 1879, October 3.—No. 3972.

ROBERTS, OWEN.—" Apparatus to be used in tin plate " manufacture."

This invention relates to an apparatus for putting the plates into the various baths, and removing them therefrom without the use of tongs. It consists of two frames of the same size and connected together one above the other. To the lower frame is attached a series of arms, sufficiently far apart for the plates to rest between them, and cross pieces, held up by a catch are provided, upon which the lower edge of the plates rest while they are within the apparatus. The apparatus containing the plates is put into the various baths successively. When the operation is completed, the cross pieces are released by moving a hand lever, and the plates drop out from between the arms. The apparatus is preferably lifted from one pot to another by a crane.

[*Drawing.*]

A.D. 1879, October 9.—No. 4087.

JOHNSON, JOHN HENRY.—(*A communication from Henri Marie Auguste Berthaut.*) — (*Provisional protection only.*) — Manufacture of aluminium and magnesium.

To obtain aluminium economically, a bath of double chloride of aluminium and sodium, melting between 180° and 200° Cent., can be kept liquid by moderate heat. The chloride is placed in a vessel varnished inside, and divided by a porous partition or by employing a porous vessel. A metal blade or plate, communicating with the negative pole of a dynamo-electric machine, and serving as a negative electrode, is introduced on one side of the partition and receives a deposit of aluminium. There is on the other side a compressed mixture of alumina and carbon, serving as a soluble positive electrode; it is gradually converted into chloride of aluminium and keeps the bath uniform.

To obtain magnesium, its chloride replaces the double chloride of aluminium and sodium, and magnesia replaces the alumina.

[*No Drawings.*]

A.D. 1879, October 11.—No. 4117.

ALEXANDER, JOHN, and McCOSH, ANDREW KIRKWOOD.—Purifying furnace gases.

Apparatus, to which the inventors' subsequent Specification

No. 1433, A.D. 1880, relates, may replace the atmospheric condenser pipes referred to below.

Products of value may be obtained, while purifying blast-furnace gases for use in stoves and furnaces. The gas main, which may be connected to several blast furnaces, leads to atmospheric condenser pipes (as used at gasworks) with troughs for collecting tar etc. Thence the gases are passed upwards through scrubbing - columns, containing perforated boards or metal plates (forming partial horizontal divisions), and supplied with water to absorb ammonia and other soluble volatile impurities. Lime or other chemical purifiers can be also used, a fan or blower ensuring the flow of the gases through the apparatus.

[*Drawings.*]

A.D. 1879, October 17.—No. 4206.

JUSTICE, PHILIP SYNG.—(*A communication from Edward Charles Hegeler, and Frederick William Matthiessen.*)—Furnaces for making zinc.

In furnaces for making zinc in externally heated fire-clay retorts or muffles, to uniformly and economically heat a large number of retorts and render them easily accessible for charging, etc ; the patentee constructs a connected series of retort chambers, or preferably a long flue-like chamber, arranged vertically, up and down, or zigzag, or horizontally. The partially burned gases from a gas generator or direct thick grate fire pass through the chambers, and are gradually burnt to heat the retorts by admitting air into or between the chambers, or at intervals along the flue-like chamber ; so that the gases are completely burnt in the last chamber, or extreme end of the flue-like chamber. Hot air may be admitted as above described to burn the gases, and also be admitted into the fire under the gas generator for their production. By arranging the flue-like chamber horizontally, the retorts can be easily accessible from one floor : this arrangement is made practicable by burning the gases by instalments, as their comparatively greater velocity in the direction of the flue's axis (caused by its narrow interior profile when compared to its length) will make them pass along the horizontal chamber nearly as rapidly at its bottom as at its top side. The air may be heated by a separate fire or by the burnt gases from the zinc furnace, thus saving fuel.

Perforated retorts may be used, instead of ordinary openings in the wall, for introducing air into the retort chamber of a zinc furnace between the retorts charged with ore, thus avoiding local cooling, and effecting a quicker and more perfect mixture of the air and gases and consequent combustion.

The air-heating apparatus may comprise a chamber, into which the gases from the zinc furnace are led through a flue, and which contains fire-clay and iron pipes. Beyond this chamber is another flue and a chimney, so that there is a continuous passage for the gases from the gas generator through the zinc furnace and air-heating chamber to the chimney Cold air or blast passes upwards through a part and downwards through another part of the iron pipes, being considerably heated therein, and travels on through the fire-clay pipes, where it is highly heated. The pipes are open at the ends and extend through the supporting walls or floors into spaces partitioned off into compartments, through which successively the air passes. The hot air is distributed through various flues provided with valves, so that the amount admitted at different points (including the gas flue, shewn in a Drawing as leading from the generator to the retort chamber) can be controlled, there being sufficient air pressure caused by the draught of the furnace or by a blast fan to make the hot air flow into the furnace at any point or into the gas generator when the proper valves are open.

The application of the invention to a pair of common Belgian furnaces (one fire being employed instead of two) and to a double Silesian muffle furnace is described. The scope of the invention is defined.

[*Drawings.*]

A.D. 1879, October 25.—No. 4352.

GLASER, Friedrich Carl.—(*A communication from Rudolf Wiester.*)—Treating zinc ores.

Oxidized ores, such as calamine, hydrosilicate of zinc, franklinite, or roasted blende, are mixed with reducing-agents (coal or coke) and submitted to a temperature pushed to a white-red heat, when spread upon the sole or hearth of an English reverberatory furnace slightly lengthened. Thus nearly all the zinc present is evolved as vapour, which is immediately burnt and

retransformed into oxide, the zinc flame indicating the progress of the operation. The said oxide passes with the other products of combustion by an inclined flue into a refrigerating-chamber, which may be constructed of wood (except the inlet side). Its cover is a perforated iron basin, whence water runs like rain and cools the gases passing through the chamber. The gases mixed with oxide of zinc now enter condensation chambers, which may be formed of suspended cloth, and with cloth sacks or bags in the form of hoppers for their bottoms. The capacity of the chambers is such that the speed of the gases is reduced enough to give the oxide of zinc time to deposit and collect in the bags, which are opened to empty the chambers. The oxide is transformed into metallic zinc by known methods in crucible furnaces. The oxide of zinc, carried with the water away from the first-mentioned chamber, may be collected by deposition in a clarifying vessel for further treatment.

Differences of construction are permissible, the invention being for the conduct of the operation as a whole. Poor ores may be treated.

[*Drawings.*]

A.D. 1879, October 27.—No. 4363.

HOPE, Lieutenant Colonel WILLIAM, and RIPLEY, ROSWELL SABINE.—Metallurgical processes.

As improvements upon the prior Specification No. 1421, A.D. 1879, the lining of the gas furnace may consist of bricks, formed of plumbago in admixture with fireclay, steatite, or cryolite, to resist fluxes and somewhat conduct heat. These bricks are supported by a chequerwork of firebricks in surrounding flues, so as to leave a free passage for heated gases behind the plumbago brickwork. The flame is carried round the outside of the purifying-pot to increase and maintain the heat in the melted metal, the gas and blast of air being introduced through or from the side of the chimney into the melting-shelf along which the flame passes, and down into the purifying-pot. More gas burners and air pipes are here provided. After playing over the metal in the pot, the flame traverses flues at the sides of and beneath the latter and the melting-shelf. A hanging bridge descends somewhat into the purifying-pot, into which metal may be tapped direct from the melting-shelf. This shelf should be long and narrow to facilitate

rapid melting by the flame, and the pot should be deep and narrow, so that the chemical blast employed may in rising thoroughly permeate the molten metal. Sometimes chemical substances may be blown or thrown into the said shelf and pot. Molten metal in the shelf may be agitated by a blast of hydrogen or say, "Harkness gas" introduced by short plunger pipes or tuyères. After slag has been tapped off, the metal may be run into the pot, and a chemical blast be employed to act partly chemically and partly mechanically as a stirrer. The pot may have a double tap-hole; the inner one, which is manipulated like that of a cupola, is cut in a wedge-shaped block of steatite, plumbago, or other brick, which is occasionally drawn out to rake out slag or to tap and rake out metal if sluggish from want of heat. Manholes, with movable covers and little windows, may be also used. By suitable additions, alloys of any metal may be made in the pot.

The gas and air may be introduced downwards at an angle of about 45° to the melting-shelf, which may be also used for reducing ore; or the shelf may be dispensed with if the metal be melted elsewhere.

The plunger pipes are preferably made of plumbago, strengthened by a central wrought-iron pipe, which has a thick covering of asbestos, gannister, or the like, inside the plumbago. Sometimes the tops of two or more pipes may be fastened in an iron frame and lifted together, and telescopic pipes may intervene between them and the blast pipe.

In a modified furnace, the purifying-pot is placed next the chimney, and in size and shape it resembles the melting-shelf (when used). Thus the pot will contain only a shallow depth of molten ore or metal, and heat and fluidity may be maintained without externally heating the pot. Two, three, or more plunger pipes should be here used according to the length of the pot, which inclines very slightly towards the tap-hole. Its floor should also incline from the sides to the centre.

[*Drawing.*]

A.D. 1879, October 31.—No. 4436.

WEBSTER, JAMES.—Producing aluminium bronze.

A coating of aluminium (from 1 to 10 p.c. by weight, according to the quality and hardness of bronze required) may be

deposited by electric battery or otherwise upon cleansed sheet copper, which is then melted in a crucible or suitable furnace with 1 p. c. (more or less) of an alloy termed No. 2. When well mixed, this molten metal is cast into ingots etc., and constitutes the aluminium bronze, which is suitable for ships' sheathing and for ordinary strong and tough castings. Where greater strength and hardness are required, from 2 to 6 p. c. of the alloy No. 2 may be added. Granulated or other copper, or a mixture of copper and zinc, may replace the sheet copper to be coated. Or, instead of coating the copper, it may be melted alone and sufficient of the alloy No. 2 be added for different qualities of bronze, with the extra portion of aluminium as required for coating the copper.

The alloy No. 2 consists of 20 parts by weight of nickel and copper, respectively, 53 of tin, and 7 of aluminium. The nickel is first melted with 2 parts of copper under a covering of carbonaceous matter (free from sulphur), to which is afterwards added a mixture of chloride of sodium and "oxide of alumina;" and the remaining copper and subsequently the tin are gradually introduced and combined with the metallic mixture, a wooden, earthenware, or like stirring-rod being used. The broken face of a test ingot will show when there is thorough mixture. Finally the temperature may be lowered, and the aluminium be added by degrees and its thorough intermixture likewise ensured. Then the temperature is raised until the molten metal becomes thin and will run out of the crucible or furnace, like brass, being cast into ingots etc.

Instead of producing the alloy No. 2 as described, an alloy No. 2*a* may be made from the nickel, copper, and 5 parts of the tin, and another alloy No. 2*b* from the aluminium and remainder of the tin. In this case the alloy No. 2*a* may be first added to the melted coated copper and afterwards the alloy No. 2*b*, the aluminium bronze being thus formed.

[*No Drawings.*]

A.D. 1879, October 31.—No. 4439.

WILLANS, JACOB GEOGHEGAN.—Furnaces.

To produce a regular flame of high heating power and either oxidizing or reducing in reverberatory heating or melting furnaces, the fuel chamber of the furnace should be 6 feet deep

from the top of the bridge to the grate bars, and the fuel charging place be closed by a door, the ashpit being sufficiently enclosed for regulating the supply of air drawn in by the chimney draught or introduced by a blower. Thus carbonic oxide is generated, with which hydrocarbon vapour and air are mixed in suitable proportions. For this purpose a liquid hydrocarbon, preferably creosote, may be conveyed from an elevated tank through a pipe leading to the upper part of the fuel chamber, into which it drops, is vaporized, and mixes with the carbonic oxide gas ascending from the fuel, while air is also here admitted through pipes to burn the said vapour and gas When blast furnace gases are employed, or carbonic oxide gas conveyed from a distance, the fuel chamber is closed up to within about 15 inches of the top of the bridge, and the gas is admitted at the upper part of the chamber, as well as the hydrocarbon vapour and air.

[*No Drawings.*]

A.D. 1879, November 3.—No. 4473.

TELLIER, CHARLES.—Treatment of coal for the purpose of obtaining useful products therefrom.

Coal is separated from " inert " or non combustible matters by floating it in a cistern in a bath preferably of calcium-chloride solution, but other saline solutions may be employed. The cistern is formed with bituminous walls ; it terminates at the bottom in an inverted cone shape, and is furnished with a pump for drawing off the waste products through the apex of the cone. The coal is broken into small pieces above the cistern and may be agitated by suitable means. The washed coal is delivered over the edge of the cistern.

[*No Drawings.*]

A.D. 1879, November 3.—No. 4476.

JENKINS, JOHN.—(*Provisional protection only.*) — Annealing.

In the course of manufacturing tin or terne plates, a grating or frame, containing a number of plates placed vertically, may be raised by a crane and deposited upon an endless travelling chain, which carries the grating and plates to an annealing-furnace. The ordinary annealing-pots are dispensed with, and

there is constructed "at the side or other suitable part of the "furnace a passage or channel, which for its whole length and "height (or nearly so) is formed with holes by which it com- "municates with the furnace. The chain, carrying the plates "in their gratings, travels through the said passage," and the plates become annealed by the heat. The ends of the passage have self-acting doors, opening to allow the plates to pass, and then closing to prevent a current of air or gases through the passage. Again, the plates may be deposited and annealed in a heated chamber, provided with a door or cover.

[*No Drawings.*]

A.D. 1879, November 3.—No. 4481.

HENDERSON, WILLIAM.—Treating ores and regulus.

If the ores (of copper, silver, cobalt, nickel, and zinc) notably contain magnesia, lime, alumina, or other earthy matter, and silica, they are smelted into regulus of not more than 50°/$_o$ copper, adding arsenical pyrites to prevent nickel and cobalt, when present, from passing into the slag.

The ore (otherwise without smelting) or regulus is calcined as usual to drive off the sulphur and arsenic, and leave the metals as oxides. The calcined or burnt ore or regulus is mixed with bisulphate of soda ("nitre cake") or analogous bisulphate in proportion to the amount of metals (above named) to be converted into soluble sulphates. The mixture of coarsely-powdered bisulphate and oxidized ore or regulus is crushed to pass through a sieve of about the fifth or sixth of an inch clear mesh, and heated to low redness with stirring in a calcining-furnace. With a rich copper regulus containing little nickel, cobalt, or silver, the heat should be raised sufficiently to decompose the sulphates of iron and of copper first formed, when the silver and other valuable sulphates will alone remain soluble. The charge is afterwards lixiviated, and the metals precipitated as usual. The calcined copper regulus can be smelted to produce high-quality copper.

In treating burnt cupreous pyrites or other calcined ores, containing no lime etc., but little silica, and not exceeding 6 °/$_o$ copper and 3 to 5 oz. of silver, the nitre cake is ground about as fine as oatmeal, and should be gradually introduced into the mill where the burnt ore is ground to pass through a one-seventh

or one-tenth of an inch mesh; the small quantity of reagent used should be very intimately mixed, and the charge brought quickly to a full red heat.

When silver is to be extracted, no chlorides should reach the mixture from the apparatus or lixiviating-water used, and old tanks used in the first or salt process should be lined with new sheet lead.

The oxide of iron residue obtained will be valuable as a pigment. The silver from the sulphate solutions may be plated down on copper, and the pure sulphate of soda utilized.

The process may be varied according to the analysis of the ores and their contained metals, and the proportions of reagent may be varied to get rid of any elements of zinc and sulphur not properly eliminated in the first stage of calcining. Bisulphate of potash or other bisulphate may be substituted for the bisulphate of soda.

[*No Drawings.*]

A.D. 1879, November 4.—No. 4490.

GLASER, Friedrich Carl.—(*A communication from the Hoerder Bergwerks und Huetten-verein.*)—Ferro-phosphorus.

An iron compound, containing from 4 up to 50 p. c. or more of phosphorus, and applicable in "the production of phosphor-"bronze and other phosphoric metals," may be produced in blast, cupola, or reverberatory furnaces by smelting poor iron ore or pig iron containing phosphorus, or iron and steel scrap, with artificial or natural phosphoric compounds, such as poor phosphates of lime and the highly phosphoric slag produced in the "Thomas and Gilchrist" Bessemer process of making steel, and also an aluminous and silicious flux (such as ordinary Bessemer slag) to produce a very acid slag. To obtain a compound very rich in phosphorus, some previously made ferro-phosphorus may be also employed. A very highly heated blast should be used in the blast furnace to aid the reduction of the phosphoric acid.

The patentee does not claim bringing phosphorus into combination with red-hot iron, or reducing pure phosphate of peroxide of iron.

[*No Drawings.*]

A.D. 1879, November 4.—No. 4494.

LAKE, WILLIAM ROBERT.—(*A communication from Humphrey B. Dunham.*)—Crushing ores etc.

An ore-crushing machine has a spring-beam, formed of laminated plates of spring steel or flat pieces of wood, which are so superposed that the depth from the top to the bottom of the beam gradually increases from the extremity carrying the stamp head or striking device for about two-thirds of the length of the beam, and thence decreases to the other extremity. Metal bands or ties connect the separate plates at the deepest part of the beam, to which part are attached trunnions or gudgeons, so that the beam can oscillate on applying power through a connecting-rod to its short arm, the blow being delivered by the long arm, which is very elastic and receives a springing motion; a movement of considerable extent results. The stamp head, hammer, or "tup" is connected to the long arm by a rod, which is hinged to the stamp head, and has a screw coupling so arranged that the rod may be shortened or lengthened to regulate the travel of the stamp-head and weight of the blow to suit the substance treated. In a wet-stamping machine described the screw coupling is dispensed with, and the trunnions are supported on a bracket vertically adjustable by a set-screw, a like result being thus obtained. The blow is followed by an advantageous recoil of the stamp head.

To separate the crushed material, a fan may be enclosed within a case, having a mouth or outlet connected to the coffer or chamber in which the stamp head works. Thus an air blast is obtained, its strength being regulated so as to carry off all sufficiently-reduced material into chambers, the finest being blown to the most distant chamber, and the other portions to other chambers according to their specific gravity or fineness.

The material for treatment might be fed to the coffer through the centre of the stamp head, when constructed of an annular form.

The machinery, which it will be understood may be used for both dry and wet stamping, is constructed for convenient transport in parts. It may be adapted for working rock drills, "beetling" cloth, etc.

[*Drawings.*]

A.D. 1879, November 4.—No. 4498.

BEVAN, JOHN.—Refining or purifying copper.

A charge of 8 or 9 tons of coarse or blister copper is melted in a refining-furnace, and the slag formed upon its surface is skimmed off. The oxygen of air is allowed to act on the copper, through the side door of the furnace, until it is free from sulphur or in the state of "set-copper." Then the door is closed and the metal brought to the full heat. The slag obtained by admitting air is now skimmed off and a damper placed in the flue. A mixture of about 4 parts of slacked lime and 1 of common salt is then well rabbled into the copper, applying 2 or 3 barrowfuls of the mixture, a shovelful at a time, through the front door. Afterwards the damper is removed and the door closed for about 30 minutes, to again heat the metal and reduce the richness of the slag produced, which is skimmed off. A sample of the copper is assayed and, if needful, the process is repeated. When the quality is good, the copper is treated in the ordinary manner.

[*No Drawings.*]

A.D. 1879, November 11.—No. 4591.

GOTHARD, JOHN.—Treating or preparing coke.

Apparatus for washing coke. The coke is contained in a skip with a perforated bottom, fitting in a tank of water, in which it can be moved up and down by a handle connected by a hinge joint to the tank. By disconnecting the joint, the skip can be removed from the tank. The impurities washed from the coke collect in a tray which is periodically cleaned out.

[*Drawing.*]

A.D. 1879, November 12.—No. 4609.

CAREW, JAMES MUSSET. — (*Provisional protection only.*) —Obtaining cobalt and nickel from their ores.

The finely-divided ore is digested in hydrochloric or other acid to obtain a crude solution, which is heated to boiling, and sufficient carbonate of soda or other alkali is added to produce a precipitate containing the metals, the calcium and magnesium salts remaining in solution. The precipitate is digested in sulphuric acid, excess of acid neutralized by adding alkali or

alkaline carbonate, and the resulting solution heated to boiling, and then sulphide of iron with a little oxide of iron is added to it. The precipitate produced, after an hour's boiling and after filtration, will contain a little of the iron added, with such copper, manganese, and other metals as existed in the ore. To the boiling filtrate, which contains cobalt, nickel, and alkaline salts, there is added either ammonium sulphide or sulphide of cobalt with a little oxide of cobalt in quantity rather more than suffices to produce a precipitate, which, after an hour's boiling and after filtration, will contain a little of the cobalt added along with all the nickel and iron. This filtrate, which contains sulphate of cobalt and alkaline salts, is boiled, and finely divided zinc (zinc dust) is added to precipitate the cobalt. The precipitate is washed, and then digested for a few minutes in dilute acid to dissolve out any zinc compounds. It is then washed and dried, and is finely divided cobalt. To recover the nickel from the precipitate containing it, the latter is roasted to expel the sulphur, and the residue is dissolved in sulphuric acid; then the nickel is precipitated by zinc as above described in the case of cobalt. Other acids could be employed for producing the solutions, instead of sulphuric acid.

[*No Drawings.*]

A.D. 1879, November 15.—No. 4655.

DUNN, Noah.—Doors for puddling and mill furnaces.

To construct more durable doors and confine the heat within the furnace so that the working of the metal may be easier for the workmen, the inventor forms the door with a water chamber between an outer and an inner iron plate, on the other side of which latter there is the usual course of fire-brick. The door is cooled by a constant circulation of water which, according to a drawing, is introduced into one side of the water-chamber through a vertical pipe, passes beneath a central division in the chamber, and escapes through an overflow pipe into a vertical rectangular waste pipe, the latter having a partially open front to allow the overflow pipe to rise with the door when opened. The water from the waste pipe may traverse the hollow foreplate upon which the door descends; but this is not claimed.

[*Drawings.*]

A.D. 1879, November 15.—No. 4668.

BARLOW, Walter Alfred.—(*A communication from Charles de Vauréal.*)—" Treatment of sulpho-antimonious and sulpho-" arsenic gold and silver ores."

The finely-ground ore is heated to dull redness in a gas retort. A stirrer parallel to the axis of the retort, which is capable of rocking somewhat, continually disturbs and changes the material at the surface without lifting the particles, while a current of hydrogen gas traverses the retort. Thus the sulphurets of arsenic, antimony, and silver will be reduced, hydrosulphuric acid being formed and the arsenic distilled. These products pass into a chamber, where the arsenic remains, and the said acid is condensed in a purifier with divisions dipping into a chalk bath. The excess of hydrogen is conducted into a second retort for further like use, the work proceeding successively in different retorts. As poisonous arsenical hydrogen is produced, the residual unabsorbed gas is burned in the furnace.

The residual ore, which contains sulphuret of copper, reduced antimony, antimonial silver, and gangue, after being crushed, is roasted and oxidized at not exceeding a dull red heat in a reverberatory furnace. Thus the sulphuret of copper is converted into oxide and sulphate, and antimonious acid and antimoniate of oxide of antimony are produced. This last salt not being soluble in water or diluted sulphuric acid, the roasted regulus is treated with cold sulphuric acid of 12° density, wherein the oxide of copper dissolves, and iron precipitates the copper. Or commercial sulphuric acid of 66° may be used, heat being then developed. By methodical washing, a less dense acid liquor may be brought upon the richest roasted regulus. The residue, freed from copper, after a water washing is treated with concentrated hydrochloric acid in a closed vessel lined with lead, the antimoniate of antimony being converted into oxy-chloride of antimony which is run off. Concentrated solutions of the oxychloride are obtainable, whence the antimony is extracted or antimonious vermilion made, and the residue will contain all the silver as chloride.

To extract only silver, the residue may be treated with bisulphite of soda which dissolves the chloride of silver. Or both gold and silver may be extracted by amalgamation. After " dechloruration " of the silver, the residue may be treated with

boiling sulphuric acid; the sulphate of silver is then reduced by copper. In extracting by the dry way, the dechlorurated residue is mixed with one-half part of litharge and a little charcoal, and the mixture is cast with lead. During the scorification the scŏria must be agitated with green wood, and towards the last a little iron is added to reduce the excess of oxide of lead in the scoria, which is then run off and replaced by more of the mixture to enrich the lead bath. This last is treated by zinc or cupellation.

The residue may be also treated with protoxide of lead, the silver being dechlorurated by a chalk bath or a washing of potash with a little molasses at 100° Cent.

Ore, with a calcareous or dolomitic gangue, should be washed in weak hydrochloric acid before reduction by hydrogen. The description includes pulverizing the ore with 10 to 20 p. c. of sulphuret of lead and 8 to 10 of chloride of sodium, and then reducing by hydrogen at a dark red heat, lead, antimony, and the precious metals forming an alloy. Afterwards the mass is roasted and oxidized in the same gas retort at a low heat. Then the temperature is raised to promote fusion of the chloride of sodium and the reaction of the sulphates upon this salt. It is distilled from the chloride of antimony which is condensed. The fused matters are received in cast-iron forms, where they separate themselves in a metallic bulb and in a mixture of chlorides (which are used again). The matts remaining in the retort, after sudden cooling by immersion, are treated by the dry way for copper, or by the humid way after grinding and roasting, in which case their sulphatization is completed in lixiviating apparatus, where the sulphurous acid from the roasted matters with excess of air is condensed. The metallic alloy, containing the precious metals and antimony, is scorified at a low temperature and tested.

[*No Drawings.*]

A.D. 1879, November 19.—No. 4698.

CAWLEY, JOHN.—(*Provisional protection only.*)—" Working " of casting pots."

The height of the pot is extended by an upper portion, fitting into its top and having a sliding cover in two halves, but with a central opening left through which the metal can be passed

into the pot, and risk of not throwing in all the metal is avoided. Afterwards a cover is placed on the opening to entirely close the pot, which retains the heat, fuel being economized.

[*No Drawings.*]

A.D. 1879, November 19.—No. 4700.

REID, WALTER FRANCIS.—Separating the tin and iron of tin-plate scrap, waste tins, etc.

The scrap is roasted at a dull red heat with free access of air, whereby all the tin and part of the iron are oxidized and form a thin brittle coating of stannic and ferric oxides. By passing the roasted scrap through edge-runners, rollers, or other apparatus, the coating is detached and converted into a powder, which is separated by sieves or other means from the unoxidized metallic iron. The tin is recovered from the mixture of stannic and ferric oxides by any usual method for reducing tin from its ores; or the two metals may be reduced together at a temperature not sufficient to fuse the iron, and the tin be then extracted in the wet way by acid or alkaline solutions.

[*No Drawings.*]

A.D. 1879, November 20.—No. 4715.

STOCKER, THOMAS.—Setting or working china clay.

The invention consists in means for separating china clay from sand, gravel, and other impurities by washing.

The clay is broken up in the usual manner and treated with water, which carries it away together with sand and stones with which it is mixed. The stream is directed into boarded channels. The greater part of the water free from gravel and stones passes over hatches, into a receptacle, and thence into tanks, where most of the sand is deposited, and the water carrying the clay flows away to a clay pit. To remove the sand and gravel which collect in the channels, a wagon is pushed into a suitable position, and hatches which have served to confine the deposited matter in the channels are raised, when the stream of water rushes forward, carrying the gravel etc. into the wagon.

In place of a wagon, boxes carried on an an overhead rope line may be employed to convey away the deposited matter.

[*Drawings.*]

A.D. 1879, November 21.—No. 4747.

IMRAY, JOHN.—(*A communication from Johann Thelen.*)—Stirring, crushing, and conveying apparatus for drying and calcining ores and soda ash, and for other purposes.

Referring to the prior Specification No. 4875, A.D. 1876 (which relates to removing deposits from evaporating-pans etc.), the present patentee in calcining ores etc. applies crushing in connection with apparatus, wherein a revolving shaft extending along a semicircular trough carried several radial arms, to the ends of which were hung loosely flat blades or scrapers placed somewhat obliquely to the axis of the pan, so that, revolving continuously in one direction round the surface of the pan, they scraped the deposit therefrom and moved it forward on to the path of the next blade, and so on, until it was removed from the end of the pan by a scoop. At intermediate points between the arms carrying the scrapers there are now provided other arms carrying rollers, which crush the material in the pan as it is conveyed along, so that it is more effectually heated by the subjacent fire. The axes of the rollers preferably run in slots so that they shall bear with their whole weight in crushing.

Sometimes the shaft receives a reciprocating rotary motion; and has only two sets of radial arms with scrapers or blades so arranged at an angle to each other that, as the shaft partly revolves in one direction, one set of blades conveys the material on to the path of the contiguous blades of the other set, which then descends along the surface of the pan while the first set recedes again, and so on, each set alternately conveying the material a step forward towards the end of the pan, there to be removed by a scoop attached to one arm or to fall through an end aperture. For calcining, one or more heavy crushing-rollers are preferably also provided.

[*Drawings.*]

A.D. 1879, November 25.—No. 4804.

KING, JOHN THOMSON.—(*A communication from Charles Forster*).—Rock and ore crushers.

One jaw of the machine is pivoted so as to oscillate or vibrate laterally in front of a fixed jaw, the jaws having curved or angular surfaces, so that the ore will be nipped, crushed, and

ground between the concave portions of one jaw and the convex faces of the other.

The fixed jaw (in a frame at the outer end of the bed) has its working face slightly inclined down to the discharge opening, while the movable jaw (provided with a stem or pivot, which extends down into a seat in the bed) has a vertical working face. The pivot extends down below the working face of the jaw. A bolt, through the pivot and bed, holds down the jaw, while a loose disc, inserted in the seat, relieves the friction of the working face of the pivot. Towards the rear a semicircular guide or bearing extends up into the jaw, which is chambered to receive it. The working faces of the jaws are corrugated (upwards and downwards, according to a drawing), the full parts of the one being opposite the hollow parts of the other; the oscillation thus causes crushing and grinding. The moving jaw has a rigid arm or lever, which extends back to a supporting guide-plate, and is reciprocated by a link and cam-wheel or otherwise. Removable bits or faces are keyed into the jaws. The fixed jaw is adjustable to enlarge or reduce the width of the opening between the jaws by means of liners, inserted between it and the frame. The wear is chiefly upon the lower parts of the jaws, and, to reduce the width only at the discharge opening, the lower edge of the fixed jaw may be advanced by raising a wedge or incline by means of screw rods extending up between the jaw and frame. The arrangement prevents strains from forcing the moving jaw out of position.

[*Drawing.*]

A.D. 1879, November 25.—No. 4806.

GLASER, Friedrich Carl.—(*A communication from the Vereinigte Koenigs & Laurahuette.*)—Refractory basic material.

To produce basic stones from dolomite, silicate of magnesia, or lime artificially mixed with silicate of magnesia, the respective pulverized materials are thoroughly mixed with from 5 to 10 p. c. of sulphate of magnesia or sulphate of soda and of chromate of iron, together with animal blood and sometimes a solution of green vitriol, to produce a composition, not plastic but loose or light, from which bricks, tuyères, furnace linings, etc. are pressed and dried at a moderate heat. The dried

objects are hard and firm like stone, not injured by rain and damp, and workable with the mason's hammer.

The material described may be used in a burnt or unburnt state.

[*No Drawings.*]

A.D. 1879, November 25.—No. 4807.

GLASER, Friedrich Carl.—(*A communication from the Vereinigte Koenigs & Laurahuette.*)—Refractory basic material.

To avoid the shrinkage, distortion, and flaws produced by burning at a high temperature objects made from crude dolomite or limestone, the patentee first dead-burns the crude stone. Objects made from the powder of the dead-burnt stone with organic binding-media, such as tar, oil, blood, etc., become hard and firm after exposure for 2 or 3 hours to an ordinary white heat, without further shrinking, while the binding-media are entirely burnt.

Dolomite or limestone is therefore burnt at a high white heat until it presents a perfectly-black and faintly-glistening fracture, and on cooling does not fall to pieces in the air. The purer the stone, the higher the temperature and longer the time required for dead-burning. Pure limestone may also be mixed with impure limestone, or with silicate of magnesia, cryolite, or fluor-spar, or with chromate of iron and sulphate of magnesia and similar fluxes. "In such a case lumps are made of the pul- "verized mixture with the application of thinned animal blood "or a solution of green vitriol: they are dried and then dead "burnt."

The pulverized dead-burnt stones are intimately mixed with tar, a solution of bitumen, linseed oil boiled with some litharge, or syrup; and basic bricks, furnace linings, etc. are pressed from the composition (which should be rather light and not plastic); or the latter may rest until somewhat dry, and then be mixed with blood, thickened by a little sulphuric acid.

The objects are afterwards subjected to the finishing burning process. Large or complex objects (including tuyères and converter bottoms) may be burnt in well fitting casings of light sheet iron, to prevent shrinkage at first when the objects are somewhat soft. On the temperature being raised, the casing burns away, leaving the objects with a clean surface.

[*No Drawings.*]

A.D. 1879, November 25.—No. 4811.

KAGENBUSCH, John Peter.—(*Provisional protection only.*)—Extracting and manufacturing aluminium, aluminium bronze, and gold from clay, dross, and other substances.

To obtain aluminium from clay (or gold from clay or slag, the gold being chemically combined with the silica and alumina in the iron slag or clay), fluxes are employed to bring the clay (or slag) into a liquid state in a crucible or furnace ; and then copper and zinc are added to create electricity in order by decomposition to separate the aluminium (or gold). Afterwards lead is added and forms with the aluminium (or gold) an alloy, which is separated from the slag, and cupelled, the aluminium (or gold) remaining in the cupel.

To obtain aluminium bronze, the same process is employed as for aluminium, but copper is added (instead of lead) according to the percentage of aluminium required for the bronze.

[*No Drawings.*]

A.D. 1879, November 25.—No. 4814.

DODGE, James.—Furnaces.

In furnaces for melting metal in crucibles, the inventor makes the casings (which may be of sheet iron or other metal) and linings (which may be of fireclay or other refractory substance) in separate portions or sections, so that an injured part of the furnace may be replaced. The crucibles are placed on fireclay stands resting upon the grate bars, to which is attached a screw shaft for raising and lowering them together with a plate for closing the bottom of the furnace by the aid of sand. The furnaces may be in duplicate, with a communicating flue. Crucibles being placed in both furnaces, and coke in the first furnace, the flame passes therefrom to heat the crucibles raised into position in the second furnace. When the metal is melted in the first furnace, the crucibles in the second may be transferred to the first to complete the melting of the metal in these crucibles. Or coke may be placed in the second furnace, and crucibles containing fresh metal be raised into position in the first, the operation being reversed.

A frame carrying the grate bars and crucibles might be rotated to effect uniform heating. Sometimes the crucibles

might be dispensed with, and the metal heated by the direct action of flame.

[*Drawing.*]

A.D. 1879, November 25.—No. 4821.

ELMORE, WILLIAM.—Alloys of iron or steel and nickel; and "nickel bronze."

To molten iron or steel there may be added a pulverized "nickel mixture" (consisting of about 85 to 95 p. c. nickel to 15 to 5 p. c. magnesia) in the proportion of "from 1 per cent. "upward to 99 per cent. downward of iron or steel." The higher percentages of nickel give the higher qualities of alloys, 10 p. c. of the nickel mixture being preferred. The use of nickel imparts some brittleness; the inventor therefore employs "magnesia to secure the malleability and ductility of the "resultant alloy," which is also inoxidizable. Hence this alloy may be used for ship plates, screw propellers, etc. Also the alloy will retain the latent magnetism when used for electro-magnets.

The nickel bronze is produced by the admixture in a molten state of about 20 to 80 parts by weight of iron with 18 to 5 of the pulverized nickel mixture and 62 to 15 of copper. It may be used for bearings and fittings of machinery, for sheathing plates, and otherwise as a cheap bronze.

[*No Drawings.*]

A.D. 1879, November 28.—No. 4879.

GUTENSOHN, ADOLPH.—Separation of the tin and iron in tinned iron waste.

In connection with a reference to the inventor's prior Specification No. 3943, A.D. 1879, the following description may be here inserted.

In a vessel containing hydrochloric acid is placed the waste, which is withdrawn as the tin is removed from the iron; and this is repeated until the solution is saturated (or the acid may be run from vessel to vessel, containing tin cuttings, until it is practically saturated). The vessel is then converted into a kind of galvanic battery by immersing a porous cell containing zinc (for the negative pole) with one of the elements usually employed in chemical batteries. The positive pole is formed of

tinned iron waste immersed in this saturated solution. The current generated is led into a second vessel, containing a similar solution to the foregoing, as well as tinned iron waste. The action in the first vessel deposits metallic tin from the solution, while the tin is dissolved from the waste immersed therein, thereby keeping the solution saturated, and the waste is replaced as the tin is removed from its surface. Sulphuric, nitric, or chromic acid may replace hydrochloric acid.

The claim relates to separating the tin and iron by an electric current "generated in a battery of which at least one element "is formed by the waste material and solutions of salts obtained "therefrom."

[*No Drawings.*]

A.D. 1879, November 29.—No. 4898.

JENSEN, PETER.—(*A communication from Georg Höper.*)—Treating copper to be used for printing rollers.

Electrolytical copper (that is, copper deposited approximately pure by the electric current) is to be used for casting the roller ingots, the comparative hardness of castings of this copper ensuring a greater durability to the engraved patterns. By adding sufficient phosphorus to the molten electrolytical copper to impart about $\frac{1}{4}$ per cent. of phosphorus to the casting, the elasticity of the copper is increased, and the edges of the engraved lines come up sharper and clearer. The fusion of electrolytical copper with other copper will impart to the latter proportionally the qualities described. If about 2 parts of electrolytical copper be mixed in casting with 1 of ordinary copper, a roller is produced superior, as regards hardness, elasticity, purity, and evenness, to rollers cast from such copper as is obtained from old printing rollers, and containing up to about $\frac{1}{2}$ per cent. of impurities.

[*No Drawings.*]

A.D. 1879, November 29.—No. 4904.

DERING, GEORGE EDWARD.—Manufacture of bricks for refractory linings of furnaces etc., and making crucibles etc. to withstand high heat.

Reference is made to the prior Specifications No. 908, A.D.

1872, and No. 4780, A.D. 1878, (which relate to analogous subjects), and to the "Thomas-Gilchrist system" of lime linings.

The inventor moulds pulverulent anhydrous "limes," including highly-calcined or "over-burnt" lime, into basic bricks etc., under the great pressure of from about 7 to 40 tons per square inch, the lime being preferably charged red hot, or nearly so, into the mould. These bricks, after only moderate firing (the temperature being raised gradually), are very hard, neither shrunk nor distorted, and withstand exposure to damp air or high temperatures without disintegration; sometimes previous firing is dispensed with. Partially-hydrated lime or slaked lime may be likewise compressed in a cold state, the resulting bricks requiring to be slowly dried in the air or otherwise before being burnt. Different varieties of limestone and chalk, with or without a little water, may be used, but are more subject to shrinkage and distortion in firing. Also lime, moistened by exposure to the vapour of petroleum or other liquids without action upon it, may be employed. Again, anhydrous burnt gypsum (plaster of Paris), or even highly-calcined or "over-burnt," or slightly-moistened, plaster of Paris may be similarly formed into refractory neutral bricks. An intermixture of other refractory or of binding-substances (such as ground coke or plumbago, and burnt fire-clay or oxide of iron) may be sometimes employed. Also bricks, having a face or coating of magnesia or other costly basic or refractory material, may be obtained by placing a stratum of the latter within the mould before pressure is applied. Moulds of very thick cast iron or of cast steel are preferred, with plungers or pressing-surfaces of tempered steel.

Crucibles, Bessemer tuyères, and other metallurgical articles may be likewise made.

[*No Drawings.*]

A.D. 1879, December 2.—No. 4925.

SMITH, Michael Holroyd.—Protecting metals and metallic vessels from the injurious action of other metals when heated.

Iron and steel are to be protected with a coating of magnetic or black oxide of iron formed upon the metal in any efficacious way. Ladles, tanks, and like articles of iron and steel, intended to contain molten zinc, lead, tin, or kindred metals, are thus made more durable, while the molten metals are kept pure

because the said coating prevents their amalgamating with the iron or steel. The articles may be coated by being placed in an externally-heated chamber or furnace, the temperature sufficing for them to decompose steam or aqueous vapour, which is allowed to circulate around them. Or the articles may be placed in a chamber without being heated, and superheated steam may circulate around them until the coating is produced.

[*No Drawings.*]

A.D. 1879, December 2.—No. 4926

WALKER, Samuel.—Treating copper for making castings.

To prevent porosity or unsoundness in the castings, the inventor adds to the molten copper some cryolite (double fluoride of aluminium and sodium) or other natural or artificial compound of similar composition, with or without borax ; and soon after this flux has thoroughly melted, he pours the melted copper with or without the flux into the mould. When ductility is also required in the casting, acetate of lead is mixed with the cryolite employed.

[*No Drawings.*]

A.D. 1879, December 3.—No. 4951.

JORDAN, Thomas Brown, and JORDAN, Thomas Rowland.—Pulverizing rock, mineral, or other material.

Two castings, bolted together by flanges on a vertical or horizontal centre line, form a shallow cylindrical chamber, within which two cast-iron or steel fans or beaters revolve in opposite directions, say, from 1000 to 1500 times a minute, upon shafts with driving pulleys keyed on their outer ends. The shafts have long bearings carried by the castings, and meet end to end in the centre of the chamber. The faces of arms or blades, carried by the beaters, make an angle of about 45 degrees with the axis of the shafts, those on one beater being parallel to those on the other in the horizontal plane.

The material for treatment, fed into a hopper above, passes uniformly on to the revolving beaters from the upper extreme portion of the periphery of the chamber, thus falling in its crudest and largest form upon the circumference of the beaters, that is, at the points of highest velocity and greatest impact. The arms of the beaters revolve nearly in contact with each other

and with the sides and periphery of the chamber. Thus the material is struck to and fro by and against the two opposite beaters in turn, and is made to converge to their vertical centres, and does not strike the periphery of the chamber with any degree of centrifugal force. The material is thereby pulverized as it falls through the chamber, the fineness of the product being determined by the velocity of the arms and the position of the outlet openings from the chamber. The outer points of the arms may be bent forward in the direction of rotation to prevent the material from jamming between the arms and the casing. The said hopper may have a feeding tray, the inclination of which is adjustable by a screw ; a paddle feed wheel, fitted with hard brushes or india-rubber pads, may revolve in the mouth of the hopper. Sometimes the hopper is fitted with two breaking-jaws, by which the material is first crushed to a uniform size. The outlet openings may be sometimes fitted with a grating or sieve. There may be two outlets, placed opposite to the arms of each beater in the direction of their respective rotations, and made adjustable as to their distance from the bottom of the chamber by means of sliding shutters, whereby the lower edge of the outlet can be raised, or this may be otherwise regulated.

[*Drawing.*]

A.D. 1879, December 17.—No. 5174.

CLARK, Frederick Aldridge.—Manufacture of lead and other soft metal pipes.

To avoid loss of time during which the machinery stands idle whilst the lead container is receiving the molten metal, and in waiting whilst the metal solidifies to receive the pressure by which it is driven as a pipe or rod out of the container, the pressing-machinery is combined with a double or with two or three containers, so that one may be in position and be pressed whilst the other is receiving its charge of metal and standing for the metal to solidify. When the charge of one of the containers is exhausted, this container may be moved away and the other container brought to its place. These containers are formed of cast steel, and the two containers may be made in one block which is mounted in the press on a revolving, sliding, or other table.

[*Drawing.*]

A.D. 1879, December 22.—No. 5230.

NEWALL, Robert Stirling.—Furnaces for calcining, etc.

Reference is made to the prior Specification, No. 2073, A.D. 1876 (which relates to a furnace, having a circular revolving bottom, and wherein burnt copper ore may be calcined with salt in the wet extraction of copper), and No. 3486, A.D. 1877.

Furnaces, having a horizontal rotating bottom with a central opening, may be fitted with apparatus for stirring the materials under treatment and afterwards discharging them through the central opening. Several ploughs, arranged in a frame which is inserted in an opening in the roof of the furnace, receive a slight oscillating movement, so as to well stir the materials by moving them towards and from the centre as the bottom rotates. Afterwards the ploughs are placed at such an angle that the materials are pushed by the said rotation against the ploughs and out at the central opening. The ploughs are fixed to axles, and receive oscillation through cranks fixed to their upper ends, a rotating crank pin, and a connecting rod.

Air might be prevented from entering the space between the rotating circular bottom and the fixed brickwork of the furnace, to which the second-mentioned prior invention relates, by a gutter, placed close to the outside rim of the bottom, and containing sand or the like, while a ring fixed to the brickwork dips into the sand.

[*Drawing.*]

A.D. 1879, December 23.—No. 5243.

PERKINS, Loftus.—Softening and again hardening an alloy of copper and tin.

The inventor refers to his prior Specification No. 3845, A.D. 1872; which relates to the use of an alloy, composed of about 5 parts of tin to 16 of copper, for the packing-rings of pistons and for other wearing surfaces. Owing to the hardness and brittleness of this alloy, it is difficult to turn and plane it: the inventor therefore now heats it to such a temperature as appears luminous, not more than blood red in the dark, and then suddenly cools it as by plunging it into cold water or oil. Thus it becomes softened, and can be turned etc., as readily as gun-metal. It may be used in this softened state, but is preferably first brought back to its original hard condition by

re-heating it to the same temperature as before, and then allowing it to cool slowly in the air.

In making the alloy, the copper and tin are melted separately, the tin is then put into the melted copper and thoroughly stirred, and the mixture is at once poured into a sand or metal mould to cast it approximately to the shape desired.

[*No Drawings.*]

A.D. 1879, December 24.—No. 5280.

CHENHALL, JAMES WARNE.—Calcining-furnaces.

The furnace has a flat bed (to contain the ore for calcination) with circular sides, and there is a round, horizontal, moveable top or arch either of iron or of brickwork encased in a circular iron band. The top is revolved by a cogged ring and machinery and has projecting arms with wheels to run on an external circular supporting iron rail, while a circumferential flange enters a fixed circular groove containing sand, thus forming a lute. Suspended from the said top and reaching nearly to the bed are six or more iron ploughs or scrapers, at unequal distances from the centre, with their faces so adjusted as to stir up the whole of the charge at each revolution of the top, thus avoiding stirring by hand. The furnace, which may be used with or without direct contact of the fire with the ore, is heated by a fire-place and flues beneath the bed made of earthen tiles or slabs. When heat is applied only under the bottom, air enters the furnace through a side opening, the gaseous products of combustion escaping through an opposite opening. Otherwise the fire gases may pass first over the ore and then in flues beneath. There is a charging opening in the top and a discharging doorway at the side.

[*Drawing.*]

A.D. 1879, December 29.—No. 5302.

THOMAS, SIDNEY GILCHRIST.—Refractory materials.

Prior Specifications Nos. 289 and 908, A.D. 1878, are referred to.

The calcareous basic slag (with less than 15 per cent. of silica), produced in the converter or open-hearth furnace in the inventor's basic process of making steel, may be sometimes used

in admixture with lime and boiled or Siemens' tar for forming converter bottoms, or in admixture with lime or limestone for repairing Siemens' hearths. The mixtures should contain under 15 p. c. of silica, alumina, and oxide of iron.

[*No Drawings.*]

A.D. 1879, December 31.—No. 5324.

BULL, HENRY CLAY.—Refractory materials.

Very strong and refractory basic bricks for lining furnaces may be made by mixing china clay or similar substance with about 10 p. c. of lime, thoroughly burning the bricks, then dipping them in a slurry made of about 70 p. c. of clay and 30 of lime, and burning them again.

The invention further relates to making iron and steel.

[*Drawings.*]

A.D, 1879, December 31.—No. 5336.

MACAY, JUAN FRANCISCO NEPOMUCENO.—Extracting metals from ores, and producing bye-products.

The inventor refers to his prior Specification No. 4218, A.D. 1879, which relates to obtaining ferric oxide (colcothar) and cupric chloride by digesting or boiling cupric oxychloride and ferrous or ferric sulphate in a solution of chloride of sodium with access of air, ferrous chloride being intermediately formed; or a solution of ferrous chloride may be used at first with the cupric oxychloride.

In extracting silver from sulphide of silver with or without native silver, the ore, after being crushed (and concentrated if needful, and especially if the gangue might decompose cupric chloride), is ground to fine powder and sifted. It is then placed in a glazed iron pot or like vessel with a strong solution in excess of cupric chloride and chloride of sodium (the latter being not necessary but desirable, because the brine dissolves cupreous chloride and checks its oxidation, and also seemingly aids chlorination); and heat is applied until the mixture has been concentrated to a pulp or evaporated to dryness. It is next ground in a stone mill, having a circular base of hard stone cemented together and encircled by a water-tight rim, while stone mullers rotate upon the base, and live steam is blown in

to heat it during grinding. The pulpy mass, which now contains chloride of silver, cupreous chloride, and free sulphur, is transferred to a wooden leaching-vat, wherein a wooden stirrer should be kept in motion. The liquid of the pulp, containing cupreous chloride and some chloride of silver, is filtered off, and the residue is washed, first with a solution of chloride of sodium to carry off remaining cupreous chloride, afterwards with hot acidulated water to remove all copper salt, and lastly with water to remove free acid. The chloride of silver in the residue may then be extracted by a cold dilute solution of "hyposulphite of "sodium," which is afterwards boiled with pulverized sulphur to precipitate the silver as sulphide, leaving the hyposulphite solution ready for use again after dilution. Or a soluble sulphide may precipitate the sulphide of silver. The latter is boiled with cupric chloride and chloride of sodium, with evaporation and sometimes grinding. The chloride of silver thus produced, after removing copper salt, is dissolved in a hot saturated solution of chloride of sodium; and, after separating by filtration the sulphur (which is pulverized for use again), metallic silver may be precipitated from the solution by metallic iron, the ferrous chloride thereby also produced being used in accordance with the prior Specification. The precipitated cement silver is melted into ingots. Instead of using the hyposulphite, the chloride of silver in the said residue may be extracted at once by hot strong brine, and the silver may be then precipitated by iron. The filtrate and brine washings from the residue may be boiled with metallic copper to precipitate, and separate as metal, the silver of the chloride present; and then the solution, after removing the excess of metallic copper, is diluted with the acidulated water washings to precipitate the cupreous chloride, which by exposure to the air is converted into cupric oxychloride for use in accordance with the prior Specification.

The silver of chloride-of-silver ores is almost insoluble in a hyposulphite solution or brine, but these ores may be treated like the sulphide of silver.

In extracting copper from sulphide ores of copper (including copper pyrites), the earlier operations are as above described, the copper being converted into cupreous chloride, which is precipitated and treated as above stated. The use of the resulting cupric oxychloride in accordance with the prior

Specification produces cupric chloride for use again ; or by means of metallic iron the copper of this chloride may be precipitated as metal, which is melted, refined,and toughened as usual.

In the case of atacamite (cupric oxychloride), the ore is digested or boiled with a solution of ferrous chloride to form cupric chloride and hydrated ferrous oxide, which latter by oxidation and heat is converted into modified hydrated peroxide of iron, and this is calcined to bring it to "the desired colour." Or chloride of sodium and ferrous or ferric sulphate may replace the ferrous chloride.

In the case of sulphide of lead or galena, the ore is treated like the sulphides of silver and copper to convert the lead into chloride. After dilution of the pulp with common water, and after filtration, the residue left is repeatedly washed with hot water to remove all the chloride of lead, which is precipitated with some cupreous chloride when the solution cools down. On boiling the precipitate with water, the chloride of lead dissolves, and (after separation of the cupreous chloride by filtration) metallic lead may be precipitated by boiling with iron, and is melted into ingots.

Complex ores, which may contain sulphide and chloride of and native silver, sulphide and oxychloride of and native copper, and sulphide of lead, with sulphides of antimony, arsenic, iron, etc., and gold (excluding any sulphides which precipitate copper from an acidulated solution of cupric chloride otherwise than as cupreous chloride) may be treated by generally similar processes to extract the silver, copper, and lead, and successively separate their chlorides. The ore is tested to see if any insoluble copper compound is formed by the treatment with cupric chloride and chloride of sodium, in which case free acid is used with these agents to prevent its formation. If antimonious sulphide be present, it becomes converted into antimonious chloride and the latter by the action of water into antimonious oxychloride, which, as well as sulphide of arsenic, gold, excess (if any) of iron pyrites, and perhaps a little chemically-combined silver, remain with the gangue. On roasting this residue, the iron pyrites is converted into ferrous sulphate, which is dissolved by hot water. The gold is extracted by known means. Lead is sometimes employed to precipitate metallic silver from a boiling filtrate containing strong brine

chloride of silver, and cupreous and perhaps a little cupric chloride, and afterwards the filtrate is cooled to precipitate the chloride of lead formed.

Sometimes the powdered ore may be transferred direct to the stone mill, where the cupric chloride and chloride of sodium are added, and the pulp is heated by steam passing through a coated iron worm, which runs round inside the mill and is preferably connected with a superheater. Or the ore may be first reduced only to coarse sand, and then put into the mill, in which case it is there ground until reduced to very fine powder.

[*No Drawings.*]

1880.

A.D. 1880, January 1.—No. 10.

FURSTENHAGEN, ISIDOR.—(*A communication from Ludwig Haarmann.*)—Basic firebricks.

A thorough mixture, containing from 90 to 98 parts of raw, unburnt, ground dolomite and from 10 to 2 parts of quicklime, used however in the state of milk of lime, is formed into bricks which are "kilned under a high temperature." The lime then amalgamates with the small percentage of silica contained in the dolomite, producing "silicated lime," which binds the particles of the dolomite.

[*No Drawings.*]

A.D. 1880, January 2.—No. 21.

MORGAN, THOMAS.—(*A communication from Baron Gustave d'Adelswärd*)—Magnesian firebricks.

Hydrated magnesia is prepared by precipitating the magnesia in natural or artificial solutions of salts thereof by pure lime, "which is added in equivalent quantity." The solutions may

be obtained by the action of hydrochloric acid or chlorine residues on magnesian rocks, such as dolomite. This process is preferable to "the employment of dolomite as a precipitant in "the place of lime," as "it enables the magnesia to be obtained "with a minimum of silica;" also common dolomite, too silicious or argillaceous for employment "in a more direct "manner, is enabled to be used in the manufacture of products "capable of resisting an extreme degree of heat." The pure hydrated magnesia is dried, calcined, pulverized, and moistened with some water to produce a very stiff paste, which is formed into bricks under a very high pressure in a mould. The bricks are dried, and then baked at a very elevated temperature for at least 12 hours. These bricks, which will resist high temperatures without deterioration owing to the purity of the materials employed, may be used for lining or protecting metallurgical furnaces from heat.

[*No Drawings.*]

A.D. 1880, January 5.—No. 36.

ABEL, Charles Denton.—(*A communication from Leonhard Wollheim.*)—(*Provisional protection only.*)—Utilizing heat contained in metallurgical products.

Heated ore, slag, metal, etc. from smelting or other furnaces are passed into closed receptacles or chambers, and air, gas, or other fluid is made to absorb heat therefrom by being brought immediately in contact therewith inside the receptacles, or conducted through passages or flues surrounding or traversing the same. A supply of heated air or gas is thereby obtained for use in metallurgical furnaces or otherwise: or the steam or vapour engendered, when a liquid is used to absorb the heat, may actuate steam or vapour engines employed on the works. Thus, much fuel may be saved.

[*No Drawings.*]

A.D. 1880, January 5.—No. 37.

WILLIAMSON, Thomas.—(*Provisional protection only.*)—Gas-heated furnaces for melting etc.

To secure greater durability, in furnaces having an air and a gas regenerative chamber below each end of the furnace, there

may be three vertical air flues and two vertical gas flues communicating between the reverberatory or main chamber of the furnace and the regenerative chambers at each end. These flues extend down to the bottoms of the regenerative chambers, but the open brickwork in the latter is arranged to communicate with the flues at the upper parts of the chambers. Thus the heated gases passing down the flues do not beat downwards on the open brickwork, which is consequently less liable to fuse, while any fused matter passing down the flues falls to their bottoms instead of choking the open brickwork. The outer walls of the flues partly follow the contour of the flues, so as to present almost the same thickness at all parts and to be subjected as uniformly as possible to changing temperatures. Beneath the middle of the furnace there is a chamber as usual, "but this "chamber is availed of to lead air up under and about the "furnace bed," such air ascending through flues in the roof of the middle chamber.

[*No Drawings.*]

A.D. 1880, January 12.—No. 133.

APPLEBY, Charles James.—Stamping ores etc.

The machinery is constructed in parts of moderate weight, easily portable and put together, and readily replaceable as regards the parts most liable to wear. Ordinary stamp heads work within boxes thus constructed :—The lower part of the box is of tough metal, preferably cast steel, with a thick bottom, the sides being thinner and sometimes tapering outwards to still less thickness at the upper part ; where the box has therefore a larger area, and where the lower edge of the upper part of the box may be fixed by bolting together flanges on the lower and upper parts of the box respectively. This upper part is made preferably of wrought-iron plates and rectangular in plan, with a side opening connected to a hopper for supplying the ore, an angle-iron being riveted round the inside of its upper edge to receive a loose plate through which the stamp may work. The lower part of the box has one or more side openings with movable frames, containing vertical or inclined perforated plates or gauze, through which the sufficiently-powdered ore is discharged, to be carried away upon tables or

by spouts or shoots attached to supports on the box. A movable (preferably cast-steel) plate or anvil block is placed upon the bottom of the box under each stamp head (one or more of which work in each box). Water is supplied to aid the process; when stamping auriferous quartz, mercury may be supplied for amalgamation. Upon the heads, made flat and level, of timber piles driven into the ground to form a solid foundation for the boxes and to withstand the blows of the stamps, there may be sometimes fitted two or more thicknesses (each of moderate weight) of horizontal wrought-iron or steel slabs or plates, to which the said lower boxes are firmly bolted. To retain the slabs, if used, or the boxes themselves in position upon the piles, preferably wrought-iron side plates embrace both the slabs and piles, being bolted or riveted through the latter.

In a modified arrangement, a rectangular wrought-iron box, containing a readily-replaceable lining of steel plates, is fitted into the upper portion of the lower part (made strong and heavy) of the box in which the stamp works. The upper part of the rectangular box supports a thinner wrought-iron box with a side-hopper. Openings to receive the perforated plates or gauze are made through both the said rectangular box and the steel lining-plates.

[*Drawings.*]

A.D. 1880, January 13.—No. 154.

JOHNSON, JOHN HENRY.—(*A communication from William Stubblebine.*)—Puddling, heating, and other furnaces.

The fire-chamber, by openings in its roof, communicates with an air and gas chamber above. A light blast is introduced into the ashpit, and blast is also supplied to the air and gas chamber. Fuel is introduced into the fire-chamber in small quantities and at frequent intervals, whereupon the gases evolved from the fuel and more or less flame enter the air and gas chamber through "the front openings;" while blast is introduced into the air and gas chamber and owing to the draught over the bridge wall, "has a tendency to seek the rear openings" (both sets of openings being in the roof of the fire-chamber). The gases, becoming intimately mixed with the air in the air and gas chamber, will pass through the rear openings into the fire-chamber near the bridge wall and, being there consumed, add to

the heat of the furnace. After the volatile gases evolved from a charge of fuel have been consumed, the entrance of blast into the air and gas chamber is checked by a valve, and the blast below the grate may be increased as the upper blast is diminished. Thus thorough combustion is effected, with economy of fuel and the maintenance of a uniform heat. An air-supplying chamber above and communicating with the fire-chamber is not claimed broadly.

The air and gas chamber might be used as a temporary storage chamber for evolved gases.

[*Drawing.*]

A.D. 1880, January 15.—No. 189.

SCOTT, James.—Crucibles.

Crucibles, to be used also as ingot moulds, are made of suitable size and form, advantageously square, tapering at bottom, turned-in at top, and provided with a cover.

In making crucibles, old ones may be ground up and about one fourth of the same used in combination with the new materials employed.

[*No Drawings.*]

A.D. 1880, January 21.—No. 270.

CHENHALL, James Warne.—(*Provisional protection only.*)—Apparatus for lixiviating metals and other substances in a soluble state.

An arm, crossing the centre of a revolving pan, carries, say, ten blades set at an angle, so that, as the pan revolves with the materials to be lixiviated, the scrapers disintegrate the whole mass, thereby allowing the hot or cold water or acids employed to thoroughly permeate the mass and take up soluble metallic or other substances.

[*No Drawings.*]

A.D. 1880, January 21.—No. 271.

CHENHALL, James Warne.—(*Provisional protection only.*)—Manufacture of zinc.

Instead of the ordinary horizontal or inclined Silesian or Belgian retort, the inventor employs earthen retorts or tubes,

open at each end, and to be closed by movable stoppers which are luted. The retorts are placed vertically in the furnace, the ends being accessible from without, above or from beneath the furnace bed. Near the upper end of each retort a branch tube is fitted to convey the vapours of metallic zinc into ordinary condensers outside the furnace. The retorts are heated to the usual degree, and, the bottom stoppers being secured, the mixture of calcined ore and coal is introduced through the upper ends. After the distillation, both stoppers are withdrawn, and the residue is pushed down through the lower end, which is again closed and the retort refilled.

Zinc ores containing lead may be treated, as the metallic lead falls towards the bottom stopper, where it may accumulate without injury to the retort, its contact with the sides of the retort being greatly reduced.

[*No Drawings.*]

A.D. 1880, January 22.—No. 283.

DAVIS, Alfred.—Casting ingots etc.

Reference is made to a prior Specification No. 129, A.D. 1877.

Ingots or other castings of steel, iron, or other metal may be condensed or compressed, while molten, by the pressure of air or other elastic gas, by connecting the cover or upper part of the mould to a pipe communicating with a reservoir of air or gas under pressure. The mould is firmly held down to its base, and its cover is tightly secured. After the metal has been poured into the mould and the said connection made, the pressure may be increased by quickly closing a valve on the communicating pipe and allowing the air or gas, admitted to the mould, to remain subject to the heat of the metal therein. Sometimes gas may be generated at high pressure in the reservoir by chemical reactions or the ignition of explosives. The said pipe may be connected to a main communicating pipe by a packed trunnion joint, so that it can be turned down along with the cover of the mould, and it is twisted in several convolutions to allow of expansion without straining its joints.

[*Drawing.*]

A.D. 1880, January 24.—No. 321.

BIGGS, Benjamin.—Obtaining tin from waste or scrap tinned iron.

After dissolving the tinned iron in acid, the tin is precipitated from the solution by sulphuretted hydrogen. The precipitated sulphide of tin is removed and then dissolved in hydrochloric acid, and the tin is precipitated from this solution by zinc.

The invention also relates to obtaining oxides of iron for various uses, and chloride of tin.

[*No Drawings.*]

A.D. 1880, January 27.—No. 365.

DALTON, George.—Breaking or crushing stone etc.

Referring to the inventor's prior Specification No. 3461, A.D. 1879, the same objects are now to be accomplished, in machines actuated through a lever, by pivoting the oscillating or movable jaw (preferably at its lower end) to one arm of a double-armed lever, mounted upon a centre or fulcrum in the framing, and the other arm or arms of which lever or levers are jointed to a lever or bar operated by an eccentric, cam, or crank upon the actuating-shaft. Thus the jaw receives a downward motion, and its lateral thrust is obtained by adjustable toggles in accordance with the prior Specification

Sometimes the downward motion is dispensed with, to economize power, or when the machine is used for breaking only. In this case the intermediate lever, to which the lever or bar operated by the eccentric, cam, or crank is connected, is bent or turned upward, and so shaped and arranged to act as a toggle, the block or crease of which constitutes the fulcrum of the lever ; and its motion is transmitted to the movable jaw by means of another toggle or set of toggles upon which it acts. The throw of the eccentric (or cam or crank) may impart either one or two crushing actions for each revolution of the driving-shaft, and the lever, operated by the eccentric, may be made in sections of length connected together by screws and nuts, so that the acting length of the lever may be varied according to the throw of jaw required.

[*Drawings.*]

A.D. 1880, January 28.—No. 384.

FISHER, John.—Treating auriferous quartz, ores, etc.

For crushing and pulverizing hard materials, like quartz, a strong dish-shaped vessel may revolve on an inclined axis and be supported in an inclined bearing, a drawing also showing a supporting-roller directly beneath it. The piston-rod of a steam or compressed-air cylinder, carried on a frame, passes through a guide and has a stamp or triturating-device at its bottom. This rod and its attachments are rotated at each stroke, and it may be fitted with an india-rubber stop to prevent its descending too low. The vessel is revolved, for instance, by the aid of levers, ratchet-wheel and pawl, and tangent-toothed wheel and screw, actuated by collars on the piston-rod. The part of the bottom of the vessel upon which the stamp head or hammer strikes is very strong, adjustable and renewable anvil plates or blocks of iron or steel being sometimes arranged within the vessel. The quartz etc. may be fed into the vessel by hand or by an endless chain of buckets, or from a hopper with an adjustable opening it may be carried on an endless belt to the vessel, which may be supplied with mercury and water continuously or at intervals. The pulverized material may be discharged with the overflowing water through an adjustable pipe, fitted into the then hollow central inclined bearing; or it may be dashed through wire gauze or perforated plates arranged above the vessel; or it may escape through a space left between the lower edge of a ring (fixed round the outer edge of the vessel) and the bottom of the vessel. Fixed brushes or the like may clean the gauze or plates, revolving past them.

Another vessel, for crushing mineral, turns upon a hollow inclined centre and rests upon a friction roller, which actuates the vessel, and is itself driven by a separate engine through an endless screw and a tangent-toothed wheel on the axis of the roller. A wheel is shown for regulating the height of the stamping-cylinder, and the rising-and-falling spindle (or piston-rod) may be inclined instead of vertical. Again, the device for pulverizing hard substances may be attached to the end of a vibrating lever actuated by hand. Parts of the apparatus should be readily renewable. The material treated may pass through two or more revolving vessels in succession.

The invention also relates to the treatment of various substances, including the cleaning of grain. The lower end of the

rising - and - falling operating - device enters the grain, as it continually falls over to the lower side of the revolving vessel. The piston, carrying the spindle with the operating-device, may be revolved upon its axis at each stroke by a movable helically-twisted bar, entering a corresponding nut in the upper end of the piston, and regulated by a ratchet-wheel and pawl, and the drawing of the machine first described shows a ratchet-wheel, which indicates the rotation of the piston-rod.

[*Drawings.*]

A.D. 1880, January 28.—No. 388.

THOMAS, Sidney Gilchrist.—(*Provisional protection only.*) —Refractory materials.

Prior Specifications Nos. 289 and 908, A.D. 1878, are referred to.

Basic linings for furnaces may be made by using a mixture of lime or (preferably magnesian) limestone with sulphate of lime or of magnesia as a rammed lining, or making it into bricks and highly firing. Phosphate of lime is a useful admixture, especially for tuyères, to check shrinkage. A mixture of about 100 parts of limestone and 60 of salt may be used for basic bricks, which are exposed to a high temperature ; a rammed lining may be likewise formed.

[*No Drawings.*]

A.D. 1880, January 30.—No. 429.

JOHNSON, John Henry.—(*A communication from William Stubblebine.*)—Puddling and heating furnaces.

As improvements upon the prior Specification No. 154, A.D. 1880, a large chamber situated above the fire-chamber is partly divided by a transverse partition into two compartments, which however intercommunicate above the partition. The fire-chamber communicates with one compartment through inlet openings in its roof "near the front of the furnace," and with the other compartment by outlet openings at the rear part of its roof near the bridge wall. Blast, besides entering the ashpit, is introduced into a chamber above and separated from the said compartments by a plate, which is perforated above the compartment situated (as shown in a drawing) over

the said outlet openings, so that jets of air are directed towards these openings. Gases evolved from the fuel ascend into the front compartment, mix with the said jets of air, and pass through the outlet openings into the fire-chamber near the bridge wall to be thoroughly consumed and intensify the heat.

[*Drawing.*]

A.D. 1880, February 2.—No. 458.

LAKE, WILLIAM ROBERT.—(*A communication from Anson C. Tichenor.*)—Extracting metals from ores.

To extract any metal from its ore, particularly the precious metals, the finely-divided ore is fed in at the bottom of a tank containing molten lead or other metal, to which an electric current is applied, as it is found that the fusion of the metal of the ore is thereby hastened. According to a drawing, the ore is conveyed down into the tank by the discs or buckets of a chain-feeder, working in a vertical pipe in the tank, and passing over pulleys. The metallic elements, which will amalgamate with lead, are at once fused, and the other constituents of the ore, owing to difference of specific gravity, float on the molten lead and are recovered. The lead, when highly charged with precious metals, is cupelled. Wires from the two poles of an electric battery are immersed in the molten metal at opposite sides of the tank.

[*Drawing.*]

A.D. 1880, February 3.—No. 470.

NANCE, WILLIAM.—(*Provisional protection only.*)—"Separating "or classifying minerals or metals."

A series of pans of different diameters, and of any shape or size, may be placed in a vertical or diagonal position, specially for separating minerals and metals from their gangue and simultaneously classifying any number of metals or minerals of different specific gravity, the different separated metals being deposited in separate receptacles. "The operation consists of "a series of hydraulic currents in the said pans, to which the "ores are submitted, and the said currents therein can be "regulated to suit every difference of specific gravity," a slight fall of water producing the currents.

[*No Drawings.*]

A.D. 1880, February 5.—No. 507.

JOHNSON, John Henry.—(*A communication from Paul Gustave Louis Gabriel Designolle.*)—Extracting precious metals from ores, goldsmiths' ashes, etc.

Ores, such as auriferous schists and sulphurets, containing gold so finely divided or under such chemical conditions that part of it has hitherto escaped amalgamation, may be successfully treated. It is stated that when clean strip iron, in contact with a slightly-acid solution of a salt of mercury, is touched with a gold leaf, an electro-chemical action takes place, the salt of mercury being instantaneously decomposed and the metallic mercury amalgamating with the gold; also that, by using bichloride of mercury, antimonial gold and telluride of gold will be decomposed, chlorides of antimony and tellurium being formed and the mercury amalgamating with the gold. Bichloride in solution in water containing some chloride of sodium is preferred to avoid the precipitation of protochloride of mercury. The mercury present should be at least five times the weight of the gold in order to amalgamate it all. Also amalgamated plates attract gold amalgam more than native gold, and powerfully attract globules of mercury however finely divided.

The coarsely-pulverized ore and the solution are introduced through a hopper into one end of a rotating horizontal iron cylinder, the ends of which terminate in truncated cones, and which contains a quantity of iron balls of different sizes; pulverization and amalgamation proceed simultaneously until the latter is complete, intimate contact with iron being obtained. Afterwards the motion of the cylinder is reversed, and the materials treated are discharged automatically through an opening at its other end, which is fitted internally with conical helical blades. The apparatus may be modified; thus, iron grinding-mills may be employed having a horizontal or vertical axis, or balls rolling in a circular trough, or the like; or the water containing the ore in suspension may circulate in vessels provided with iron perforated plates, gratings, or gauze.

Apparatus for collecting the amalgam comprises a series of amalgamated copper or silver discs or plates, rotating on a vertical shaft within a closed cylindrical case, which is fitted internally with concave amalgamated plates or annular shelves sloping towards the centre and arranged alternately with the discs on the shaft; so that the materials under treatment,

introduced through a hopper, fall on the discs (whereon they spread laterally under the centrifugal action) and on the shelves alternately as they descend through the case, which has an outlet for the refuse at the bottom. The shelves are formed in segments and are attached to the segmental sides of the case, the latter being mounted on hinges to open outwards. The amalgam accumulates upon the discs and shelves, and may be readily removed with an india-rubber scraper on opening the sides of the case, all the finely-divided amalgam being recovered.

Silver may be likewise extracted in the case of native silver or chloride of silver, or of any ores after the silver therein has been brought to the state of native silver or chloride.

[*Drawing.*]

A.D. 1880, February 9.—No. 559.

NORTHCOTE, GEORGE BARONS.—Alloy for road-vehicle steps and lamp etc. brackets.

These articles are cast in a metal which will weld with wrought iron. Casting-mixtures of wrought iron and spiegeleisen and of steel, wrought iron, and spiegeleisen are mentioned in the Specification.

[*No Drawings.*]

A.D. 1880, February 11.—No. 607.

KING, FREDERICK JOHN.—Magnetic apparatus for the separation of ores etc.

Ores and products, either naturally magnetic, or rendered so, for instance, in accordance with the inventor's prior Specifications No. 2574, A.D. 1873, and No. 296, A.D. 1874, (which relate to rendering substances magnetic by the action of heat etc., and also to magnetic separators), may be treated.

To obviate the adherence of part of the finely-divided non-magnetic substances to the magnetic machine, thus preventing perfect separation of the magnetic substances, the inventor now arranges a thin non-magnetic carrier (as of brass or zinc)

for the substances treated over the poles of permanent or electro-magnets, and imparts a reciprocating or other motion either to the carrier or to the poles, whereby all the particles are turned over or change their position, the non-magnetic particles descending to the bottom and the magnetic portion remaining on the surface for separation by a magnetic wheel.

The inventor now constructs this wheel with a periphery or circumference which is composed of iron or steel bars, placed at a suitable distance apart, parallel to the centre line or axis, and attached to a brass or other non-magnetic framework on a rotating shaft. The bars are made magnetic by contact with the poles of magnets so arranged that the bars form alternately north and south poles, the bars being notched to receive the magnets, and the interstices within the wheel being filled with non-magnetic material. The rotating wheel attracts and carries up the magnetic substances, which are brushed off into a receptacle, the non-magnetic portion being discharged without contact with the wheel.

[*Drawing.*]

A.D. 1880, February 12.—No. 617.

MICHELL, Francis William, and TREGONING, Thomas Henry.—Pulverizing ores etc.

Ores (including slimes, leavings, and refuse of ores) may pass from a hopper with water through an inlet pipe into a revolving cylinder or barrel, which contains irregular lumps (not balls or rollers) of iron, steel, or other hard crushing-substance, numerous small pieces giving a large grinding-surface. During the revolution, the lumps fall over and by one another and over the surface of the cylinder, and the ore, being thus reduced to the proper fineness, will be suspended in the water, with which it will pass out through a discharge pipe placed in the same end of the cylinder as the inlet pipe or through the opposite (and, in this case,) outlet end of the cylinder, the latter having hollow bearings at the ends. A drawing shows a cylinder, horizontal but slightly inclined towards the outlet end, and it is adapted for continuous working.

[*Drawing.*]

A.D. 1880, February 16.—No. 677.

BONNEVILLE, Henri Adrien.—(*A communication from Emil André.*)—(*Provisional protection only.*)—Refractory basic materials.

A cement is formed by slacking burnt lime and "adding at " the moment of the greatest heat about one half (by weight) " of concentrated sulphuric acid." The product, sulphate of lime, if used at once, possesses highly plastic and cementing qualities, 2 p. c. sufficing to render meagre materials highly plastic and tenacious. Or gypsum could be used.

"Raw lime or dolomite, or magnesian limestone, which con- " tains about 8 °/$_0$ of silica, alumina, and peroxide of iron, is " burnt in a pit furnace or reverberatory furnace at white heat, " so as to slag the materials as completely as possible; or the " raw materials being too pure to be slagged," silica, alumina, or peroxide of iron is added before burning; afterwards the whole is made into small spheroidal or rectangular bricks, which are " burnt in a pit-furnace or reverberatory furnace by gas or " direct flame, also by white heat, so as to be slagged." The burnt materials are withdrawn at a red heat and sprinkled with a little water, "to separate the slagged from the unslagged " materials. After having stamped and ground the slagged " materials" and added the sulphate of lime, the mass is kneaded and pressed or stamped to form objects "(bricks, " pipes, converter bottoms, plugs, stamping-mass)," which " ought not to shrink, now being fit for use without repeated " burning."

"The unslagged materials are manufactured by means of the " same mixture and method:" for "all such articles white heat " is not required, but only such heat as to separate the carbonic " acid."

For articles "liable to shrink by heat, a basic paste may be " prepared with raw limestone or magnesian limestone in " mixture with sulphate of lime, with or without" a little fluor spar, and these articles grow "harder by exposure to a " humid atmosphere."

The basic articles are used for lining furnaces, converters, shanks, &c.

[*No Drawings.*]

A.D. 1880, February 23.—No. 783.

MOIR, ROBERT MORTIMER.—(*A communication from Julien Deby.*)—Eliminating phosphorus from metals and alloys.

Reducing-gases, such as ammonia (as a source of nascent hydrogen) or carbonic oxide, may be blown through the molten metal or alloy in a furnace or vessel to remove phosphorus or its compounds. The reducing-gas can be used alternately with, or previously or subsequently to, atmospheric air when required.

[*No Drawings.*]

A.D. 1880, March 9.—No. 1012.

THOMAS, SAMUEL, and THOMAS, DAVID. — (*Provisional protection only.*)—Furnaces.

The sides, front, and back are constructed of water boshes, connected together for the passage of currents of cold water. At one end is a space for fuel, and at the other is a chamber, "heated from the flues of the furnace," and containing pipes "through which a blast of hot air is forced; the blast entering "the furnace at the sides, end, and top." A cold blast is supplied beneath the firebars of the fuel chamber. The top of the furnace is arched in with firebrick, and the walls are of firebrick enclosed in cast-iron plates, which are bolted together and have openings closed by doors or cover plates. Jets of water play upon the under side of cast-iron plates forming the bottom of the furnace. The furnace is lined with powdered flint, upon which metal may be placed for making steel and homogeneous iron.

[*No Drawings.*]

A.D. 1880, March 9.—No. 1018.

JUSTICE, PHILIP MIDDLETON. — (*A communication from Anton von Kerpely.*) — (*Provisional protection only.*) — Basic bricks and furnace linings.

The prior Specifications Nos. 908 and 4780, A.D. 1878, are referred to.

Lime (preferably dolomitic) is slowly mixed with pyroligneous acid and water, using, say, 25 cubic centimetres of wood vinegar and of water and 112 grammes of lime. This plastic material

may be used for binding lime or dolomite, but is preferably mixed with powdered dolomite or limestone which has been treated with hydrochloric acid. The prepared material, sometimes mixed with uncalcined dolomite, may be formed into bricks, which, after pressure and drying, are fired at an intense white heat for some hours.

[*No Drawings.*]

A.D. 1880, March 9.—No. 1033.

THOMPSON, ANDREW CHARLES GUY. — Treating ores, quartz, etc.

Through the centre of a globe (preferably of hard iron cast hollow) the inventor arranges an approximately-horizontal axis with its ends revolving freely in bearings in a strong frame or fork, the upper part of which has a preferably hollow vertical axis revolving in bearings upon a fixed support. One end of the horizontal axis carries a bevelled toothed wheel, which gears into a horizontal corresponding wheel, concentric with the vertical axis and fixed to the framework or other support. The vertical axis being made to revolve by a driving-pulley or toothed wheel upon it, the globe revolves with it and is also made to revolve upon its horizontal axis by means of the said bevelled wheels, the proportions of which may be varied to alter the relative speed of revolution upon the horizontal axis; or flexible cords or bands may be sometimes used. Beneath the globe is a horizontal saucer-shaped vessel, the curve of its concave upper surface being the same as or somewhat larger than that of the globe. The vessel may revolve upon a more or less vertical axis; and, when ores or other hard substances are to be pulverized, it may be pressed upwards against the lower surface of the globe with the necessary force by means of a weighted lever. When auriferous quartz is treated, mercury may be placed in the vessel to amalgamate with the gold set free by the pulverizing action. Water may be supplied constantly or at intervals; and screens of wire gauze or perforated plates may be arranged round the outer circumference of the vessel.

Further arrangements are described, the invention including the rolling of tea leaves, husking and polishing of grain, and mixing of materials together. The operations are generally

effected by the complex rolling action between the globe and the vessel. The vertical axis of the said revolving vessel may be able to rise and fall vertically to some extent in its bearings, and springs may press it upwards. The vessel may be sometimes stationary, or the globe may rotate upon either axis instead of upon both; and the "said axles" may be arranged otherwise than at right angles to each other. The material for treatment may fall from a hopper through the said hollow vertical axis upon the globe, or may descend through curved lateral tubes into the vessel. Again, the axis of the vessel may be hollow and may have hinged discharging-doors operated by a lever; or the vessel may be lowered for charging and discharging. The globe or vessel, or both, may be arranged with a variable eccentricity upon their axes. The globe may move longitudinally to and fro upon or with its axis, a cam communicating a reciprocating motion through a lever which turns upon a centre. The globe may be spherical, or more or less flattened or elongated: its surface may have ribs, grooves, projections, depressions, or arms to operate on the material. Mixing may take place within a rotating hollow globe with vertical and horizontal axes, and with a second concentric axis carrying mixing-devices and rotating simultaneously in the same or opposite direction.

[*Drawings.*]

A.D. 1880, March 10.—No. 1051.

LYTE, FARNHAM MAXWELL.—Treating ores and materials containing zinc, lead, silver, copper, and iron.

Referring to his prior Specifications Nos. 633 and 2807, A.D. 1877, and No. 269, A.D. 1879, the inventor separates the above-named metals in mixed ores (to which separation by dressing is practically inapplicable) by chemical treatment, the use of the cheapest reagents, such as brine, hydrochloric acid, old scrap zinc or hard spelter, chalk, and quicklime, permitting relatively valueless ores to be utilized. For example, the "bluestone" of Anglesea, containing blende with argentiferous galena and copper pyrites, is calcined (whereby most of its sulphur is burnt off, but part remains as sulphuric acid combined with the oxides produced), finely pulverized, and sifted. The ore is then treated with sufficient hot or boiling hydrochloric

acid of about 15 to 17 p. c. H Cl to dissolve the zinc and other more soluble bases, whereby the zinc and copper can be mostly dissolved. On decanting off and cooling this solution (which should still contain about 5 or 6 p. c. of free H Cl), most of the lead and silver (other than that remaining insoluble with the gangue) separates out of the cooling solution. On adding a second quantity of acid to the gangue, the lead and unattacked silver are chloridized and largely dissolved, together with iron as sesquichloride, which seemingly aids the chlorination of the lead and silver. On treating a fresh charge of ore with this second solution, it will take up more zinc and copper, and, becoming partly neutralized, most of the lead and silver will separate as the liquor cools, which can then be drawn off nearly free from lead or silver. By these operations, which can be repeated indefinitely in two attacking-tubs (whereof each becomes in turn the first of the series), there are obtainable (1) partly neutralized and cooled liquors, rich in zinc or copper but poor in lead or silver, and (2) gangues, wet with acid and containing the lead and silver completely chloridized. On neutralizing the liquors with chalk, the iron and alumina present are mostly precipitated, and on filtering are retained with silica, if present, and any excess of chalk. The liquor should not contain more than 4 grains of silver to each cubic foot, and this silver, if desired, may be collected by spongy lead (reduced by means of spelter from a solution of chloride of lead in brine). The copper and this silver may be also extracted by immersing scrap zinc in the filtered solution. Finally the zinc may be extracted as oxide by treating the solution while boiling with the least excess of milk of lime.

On boiling strong brine with the gangue and the separated lead and silver chlorides, the lead and silver are wholly dissolved; and, on cooling the brine (sometimes artificially) in a clean tub, most of the lead is deposited as chloride, but none of the silver provided its amount does not exceed about 2 p. c. of the lead or provided there are fully 10 gallons of brine to every 1·8 oz. of metallic silver. Strong solutions of any alkaline or alkalino-earthy chlorides may replace the brine; calcium chloride, resulting from the precipitation of the zinc oxide, and magnesium chloride being named. By immersing a strip of zinc, lumps of spelter, or zinc dust in the cooled brine, in a different tub, the lead chloride still in solution and all the silver chloride are

reduced to spongy metal. It is preferred, however, only to precipitate part of the lead, and, by agitating the brine, this light spongy floating lead gradually picks up all the silver and may become very argentiferous, heat aiding the process. Lead containing 2 to 4 p. c. of silver will, however, be rich enough for immediate cupellation. The brine, now containing but little lead and no silver, may be reheated and used again, its strength being maintained and impurities and acid removed. Lead in other states, when presenting a large precipitating-surface to the argentiferous solution, may be used, as may copper sulphide (or certain metallic sulphides).

The apparatus may comprise 2 conical, wooden, creosoted attacking-tubs (but sets of 3 or more may be used). They are arranged on a raised platform, and stand on separate movable platforms to be raised and lowered, as by an hydraulic lift running on rails beneath, so that the liquors can be rapidly decanted from one tub into the other. On a higher level is a hot brine tub, heated by blind steam through a coil or by a bottom of copper with a steam chamber beneath. The tubs are to be boiled when requisite by naked steam, blown into them through an embedded india-rubber hose or india-rubber jacketed steam pipes. Below the platform are cisterns, on one side for treating the acid liquors and on the other the brine. The bottoms of the silver-extraction tubs may be bevelled to aid collection of the precipitate. Each attacking-tub has 3 or 4 wooden plugs, placed at successive levels in the lower part of the tub, and having longitudinal holes through them, on to which may be lashed india-rubber hoses, their ends being thrown over the tub when not in use. These plugs serve the part of taps for decanting. By lowering each hose in turn, the liquors may be drawn off clear down to the gangue. The hot brine tub has one hose to flush the brine into the attacking-tubs. Underground there may be a desilverized brine reservoir with holes to pump from and manholes for cleaning.

If requisite, a second lot of boiling brine may be used to remove practically all silver and lead from the gangue, which may be placed on a drainer so that its drippings will become added to the brine. Some lead chloride, mixed with the argentiferous lead precipitate, may be reduced by spelter before fusion or be extracted by hot water or brine. There may be a pan wherein the brine, after use, is treated with chalk to purify

it, a filter press being used which runs on rails so as to serve several tubs successively.

Ore, containing no zinc or previously freed therefrom, may be treated. The iron can be thrown down by chalk before the silver is precipitated, but if the liquid be heated the silver may become precipitated ; indeed the silver may be thus separated from either the brine or the zinc chloride, leaving the lead chloride in solution, and may be extracted by acid and brine from the resulting precipitate, which contains also iron sludge. There is a reference to the separation of antimony and bismuth, but no claim is made to any treatment of these metals.

[*Drawings.*]

A.D. 1880, March 11.—No. 1058.

WIGGIN, Henry, WIGGIN, Henry Arthur, JOHNSTONE, Alfred Smeaton, and WIGGIN, Walter William.—Treating nickel and cobalt.

To impart malleability and ductility for readily rolling, pressing, stamping, and drawing, from 2 to 5 p. c. or more of manganese may be gradually added to the molten nickel or cobalt, thorough mixture being effected by stirring with an iron rod. After the agitation resulting from the said addition has ceased, the metal may be cast into ingots etc., or alloyed as usual. Manganese in the reguline or metallic state, alone or in alloy with iron (including manganese obtained by reducing its oxide and also ferro-manganese), or other alloys consisting essentially or largely of metallic manganese, may be used.

[*No Drawings.*]

A.D. 1880, March 13.—No. 1098.

LAKE, William Robert.—(*A communication from Jean Paul Simons.*)—Manufacture of crucibles, retorts, etc.

The articles are produced directly by pressure in a mould, which comprises three parts bolted together, viz., the base, which is a level table, either fixed, or movable horizontally in guides or on rollers to aid manipulation ; the mould proper or casing, which is made in one piece or of several pieces hinged or bolted

together, and corresponds internally to the exterior form of article required (including lips, lugs, flanges, etc.); and the upper part or annular lid, which is placed on the mould, and is shaped beneath to the desired form of the upper edge or rim of the article. For small crucibles, this lid can be lifted by hand. Clay is introduced, and, by the aid of a lever press, screw, or hydraulic press, a plug or piston is made to shape the interior of the article. The plug may be fixed or movable according to the pressure employed, and a slight clearance is left between it (when at the end of its course) and the annular lid for the escape of superfluous clay. The table may be used for carrying the mould to the drying-place, or the mould and article can be removed without the table. For moulding large articles, the then heavy annular lid may be fixed upon a platform, having a central opening, and being free to slide between the uprights of the machine, movable stops being provided for it. If a hydraulic press is used, the mould after pressure descends with the table on which it rests, the lid remaining in its place. Bolts and traversing or tie bars fasten the lid to the mould and table and are removed after pressure. The moulding of gas retorts is also described.

[*Drawings.*]

A.D. 1880, March 15.—No. 1112.

REYNOLDS, JAMES EMERSON.—Coating metals with galena.

Metal and other surfaces may be coated with galena, by the application of an alkaline solution of lead mixed with sulpho-urea (or similar substance). Photographic films or collodion on glass or paper may be so coated.

[*No Drawings.*]

A.D. 1880, March 17.—No. 1146.

JOHNSON, JOHN HENRY.—(*A communication from Charles Pernot.*)—(*Provisional protection only.*)—Furnaces.

Furnaces, including gas furnaces and furnaces for treating copper, lead, etc., may be so constructed that all parts of the same can be removed for repairs even while the furnace is working. Firebricks, fireclay, or other refractory materials, composing its different parts, are supported or retained by a

skeleton framework of iron or other metal built up in parts or sections, according to the shape and purpose of the furnace, so that each section is removable by a crane or other appliance, a corresponding duplicate of the part removed being exchanged for the latter. A saving of cost is effected in different ways. In the case of a Pernot furnace, the cover of the hearth may be supported by fixed brackets and be constructed in one piece, or in several for independent removal. Flues, which conduct and discharge the air and gas on to the hearth perpendicularly to the sole through openings in the cover, may be composed of framed segments. The cover and flues are provided with chains and rings, attached to the framework, to facilitate removal by cranes etc., which may form an integral part of the furnace. At one side of the cover is a charging-door. The hearth may be mounted on rollers travelling upon an inclined plate on a carriage, so as to be capable of rotation.

[*No Drawings.*]

A.D. 1880, March 17.—No. 1149.

PITT, SYDNEY.—(*A communication from Henri Guillaume Harmet.*)—Obtaining metallic zinc.

A furnace for the continuous production of zinc white (to which the invention also relates) may be modified for producing metallic zinc. The furnace has a cylindrical upright barrel (in which the roasted ore is reduced under the influence of carbonic oxide and carbon) with a subjacent funnel-like part (in or above which the zinc is volatilized at a highly-elevated temperature) and a receptacle or crucible beneath (which receives the slag from the fusion of the gangue and flux). The closed top of the furnace has a central charging-hopper with double covers to check escape of gas. A sounding hole beside the hopper is for ascertaining the descent of the materials in the furnace (wood charcoal being the combustible preferred), and also permits a little gas to escape (which aids the heating of the combustible and the ignition of the gas in front of two or more tuyères provided at the upper part of the barrel, whereby part of the combustible is there burnt and a sufficient temperature produced for reduction). The products of combustion mainly descend, and the gaseous, liquid, and solid matters, passing down into the volatilizing zone, meet highly-heated gaseous products there

generated by active combustion, tuyères being provided in the crucible portion of the furnace. All volatile matters, including metallic zinc, pass off by side orifices, which should be sufficiently removed from the lower tuyères to prevent any metal descending thereto and zinc white being produced. The orifices lead into long and narrow, upright, closed reducing chambers charged with carbon, which becomes highly heated, converts carbonic acid into carbonic oxide, and reduces any oxide of zinc. These chambers are charged at intervals through hoppers at the top, and the temperature is high enough to ensure that the vapours on leaving shall pass by inclined conduits into a condenser, which separates the zinc from the carburated gases, and these are at once utilized in the melting-furnaces, hot-blast stoves, or otherwise (heated blast being preferably thrown in at the tuyères). Depositing-chambers may be advantageously combined with the condenser.

The furnace preferably has a basic refractory lining; and the slag should be but slightly silicious. The sharp separation of the zones of reduction and of zinc volatilization is noticed.

[*Drawing.*]

A.D. 1880, March 19.—No. 1191.

WEDEKIND, HERMANN.—(*A communication from Herrmann Escherich.*)—Continuous-action gas kilns.

The improvements partly relate to the prior Specification No. 4381, A.D. 1878.

Ores etc. may be roasted. To more equably distribute the combustible gases and more rapidly mix the same with the air, the gases are supplied in fine jets, issuing at right angles to the direction of the current of the air supply to the firing-chambers of the kiln and to its longitudinal axis. The gas may issue from vertical gas pipes, proportioned in number to the width of the firing-chamber, and also from small openings in both the side walls into which gas pipes can be built. Movable vertical gas pipes may be supplied with gas from below, or through apertures, left in the roof and lined with earthenware or preferably with porcelain tubes. These tubes "are made with trumpet "mouths and turned down flanges or lips, which are let into "sand joints, in order that they may set themselves to any "accidental rise or fall in the roof of the kiln." A conical

regulating-valve fits the trumpet mouth. When gas in excess is supplied to produce a reducing-flame, in order to prevent the residue of the gas escaping unburnt, air is admitted through the gas pipes by opening valves communicating with the atmosphere at suitable periods of the working. The gases are led through channels made in the walls of the kiln, to take up heat prior to combustion. The kiln may comprise a series of parallel chambers so as to constitute a continuous and endless passage. Each chamber communicates with the two adjacent chambers by a pair of passages, placed at the opposite ends of the chambers, and so controlled by dampers that either air, gases, or products of combustion may be led in any direction through the kiln; also particular portions of the kiln can be temporarily disconnected. To facilitate charging and discharging and the use of firing-chambers of little height, a movable hearth or floor may be employed. On the latter may be set up gas pipes, channels communicating by an iron tube with the vertical gas pipes and with the gas conduits respectively. Two bent tubes, united by an inverted U-shaped pipe, may be employed for conducting the gas into the pipes set upon the movable hearth.

[*Drawing.*]

A.D. 1880, March 20.—No. 1206.

VON NAWROCKI, GERARD WENZESLAUS.—(*A communication from Gustav Ibrugger.*)—Furnaces.

As improvements upon the prior Specification No. 3654, A.D 1879, separate apertures (preferably at the side of the cupola chamber, having a recess towards which its bottom slopes) may convey the gases and the liquid metal from the cupola into the lower chamber. Thus the combustible gases are afforded a freer passage, " so that the cupola chamber forms as it were a gas " generator for" the lower chamber ; but little gas escaping through the upper open end of the cupola (which need not have a chimney and can be filled to a greater extent with fuel), and the requisite down-draught being afforded by a chimney into which the products of combustion ultimately pass. The lower chamber may have a raised firebrick bench, slab, or bridge, whereon metal is melted and runs down on to the bed to mix with liquid metal descending from the cupola. Thus the

melting and mixing may be carried on continuously. The lower chamber may be at the side of, instead of directly beneath, the cupola.

The flames and hot gases may be further utilized by being passed from the lower chamber into other chambers, in which metal can be melted on the open hearth or in crucibles, or which serve for other purposes. Sometimes heated air may be introduced into the said gases to effect more perfect combustion or to act as a vehicle for conveying the heat thereof.

[*Drawing.*]

A.D. 1880, March 22.—No. 1225.

BARKER, GEORGE.—(*A communication from Horace L. Brooke.*) —Hot-blast ovens.

To facilitate renewals and secure a maximum temperature of blast, the fireplace of the oven has an arched roof in which are a series of openings extending completely across the oven, and on each side of " each opening is a bridge wall extending some " distance above the inner floor of the oven. On one side of " the oven at the top is the inlet main, from which a series of " short pipes project communicating with the transverse mains, " which are provided with removable covers and are square or " rectangular in cross section. Dampers in the mains direct the " incoming blast into the downtake pipes, which latter commu- " nicate with the lower transverse mains," vertical pipes extending between the upper and lower transverse mains. " The " lower mains lie between the bridge walls and are provided " with thimbles or spigots, over which the lower ends of the " vertical pipes fit, where they are secured by cross pins which " sustain the mains. At their upper ends the vertical pipes " project through holes " in the lower side of the mains, and are retained by pins. The " top of the transverse mains being " removable, ready access is afforded for calking the joints " between the vertical pipes " and mains, and for removing a burnt pipe. " The downtake pipes " at their upper ends " tele- " scope on spigots or in sockets or thimbles in the mains " to provide a " slip joint " for unequal expansion. The blast may be checked by " an internal throttling thimble or neck piece " in the upper ends of the vertical pipes. The blast descends into the lower mains and rises again into the upper mains, finally issuing through " the incline and delivery pipe," the heat and

flames sweeping over the system of pipes, but the "baffle walls "prevent a direct play of the flames on the mains and the "junctions therewith of the vertical pipes." Wrought-iron pipes are chiefly or wholly employed, reasons being assigned for preferring them to cast-iron pipes.

[*Drawing.*]

A.D. 1880, March 24.—No. 1255.

WILSON, RILEY PORTER.—" Smelting ovens."

To produce metals in a pure state direct from the ore (without the "impurities which now enter into smelted iron or base "bullion of the precious metals"), vertical retorts are to be externally heated to any degree required for "the treatment "or smelting of the various ores, as iron, steel, silver, gold, "lead, zinc, &c." The retorts, which preferably consist of a fireclay, plumbago, or like upper part and of a lined iron lower part, are arranged in an enclosed furnace in nests of two or more, and are placed close to the opposite sides of the furnace alternately, so that the flame and heat may travel round each retort (except where it touches the brickwork of the furnace) and then pass to the smoke stack through an end flue and a return flue under the bottoms of the retorts, the furnace being provided with a fireplace at one end. The retorts, which are preferably oblong, may be supported upon a floor or division walls. Near the bottom of each retort are openings, in connection with "branches" leading through the furnace wall, for drawing off metal and slag, respectively, into a receiver, while, from near the upper end of the retort, pipes conduct gases and oxides into a condensing-chamber. These pipes may be cleaned by introducing steam. A luted cover or door may close the top of the retort, or a hopper may be attached and be filled ready for a charge, in which case "the excessive heat of the retort "will heat and dry the ore preparatory to its being dumped "into the retort."

[*Drawing.*]

A.D. 1880, March 27.—No. 1291.

LAKE, WILLIAM ROBERT.—(*A communication from Alfred Braconnier.*) — Refractory bricks, and obtaining magnesia therefor.

To obtain magnesia, the patentee treats "with calcined "natural dolomite such liquid residues from manufactories as "contain hydro-chlorate of ammonia and metallic chlorides," with or without free hydrochloric acid, the proportions being regulated so that the lime alone is dissolved. The purity of the undissolved magnesia depends on that of the raw material.

The magnesia is dried, slightly calcined, pulverized, and then moistened with water to produce a somewhat stiff paste, which is formed into bricks in moulds, using the highest practicable pressure. The bricks are desiccated, and then burnt for at least 12 hours in regenerative kilns, constructed of magnesian bricks, and heated by gas to the highest temperature attainable.

[*No Drawings.*]

A.D. 1880, April 1.—No. 1347.

DAVIES, EDWARD.—(*Provisional protection only.*)—Purifying and separating.

The treatment of "middlings" is described, but the machine may be slightly modified for separating ores etc., the silk employed being replaced, if required, by wire gauze, perforated zinc, etc.

The middlings pass through a hopper, with a feeding-roller and regulating-slide, on to the top end of a slightly and adjustably inclined sieve, covered with silk, set in a box with a frame, and reciprocated by an eccentric, crank, or otherwise, so that the middlings travel down the sieve. Within the box brushes are carried by endless bands and travel beneath the sieve, keeping the meshes of the silk clear, and brushing the stuff passing through the silk down the discharge spouts in the bottom of the box. A current of air, produced by blowers of the bellows type, is directed under and through the meshes of the silk to lift the light impurities, which are assisted to a bottom or other outlet by another current passing over the stuff under treatment. Another blower may create an exhaust to take away the impurities. Air from the blowers enters chambers, across the top end and down each side of the machine, and passes out of the side chambers through perforations and under the silk. The space of the box under the sieve can be used as an air chamber by providing the discharge spouts with slides. A large air

chamber may be formed by having another bottom or a partition the length and width of the sieve. Below and at a distance from the top end, pivots at the sides carry the box part of the machine, and its lower end is supported by screwed iron pins with nuts and hand-wheels for adjusting the bottom end of the box to suitably incline the sieve, which is carried by suspenders in the box. Sometimes buffers or beaters at the bottom end of the machine may slightly knock the end of the sieve frame, to keep the substances travelling down over the silk and loosen the particles so that the air may act well. Two or more machines may work in one frame.

[*No Drawings.*]

A.D. 1880, April 5.—No. 1387.

KING, Frederick John.—Treating ores etc.

The treatment includes minerals or products separated in accordance with the inventor's prior Specifications No. 2574, A.D. 1873, and No. 296, A.D. 1874, which relate to rendering substances magnetic by the action of heat etc., and also to magnetic separators. When such a mineral as cupreous pyrites is roasted to dispel the sulphur, the copper is rendered soluble in ammonia, or may be made wholly so by further roasting with or without salt, or by adding salt or salt and water and exposure to the air. Such products are placed with dilute ammonia in a rotating vessel, such as a cylindrical steam boiler on rollers, and what is soluble in ammonia is dissolved. After the solid matters have settled or after filtration (and washing), the ammonia liquor is passed into an airtight vessel, connected to an exhausting-apparatus, and the action of the resulting vacuum or partial vacuum causes the ammonia gas to be disengaged from the liquor, and the copper is thereby precipitated. Silver, when present, may be first precipitated by copper, and the copper in turn by zinc, which can be separated as white oxide by removing the ammonia gas. This gas is passed into water to form fresh liquor for further use. Heat aids the removal of the gas from the airtight vessel, which therefore preferably has a steam jacket.

Ores of zinc and silver and all minerals soluble in ammonia may be treated.

[*No Drawings.*]

A.D. 1880, April 8.—No. 1433.

ALEXANDER, John, and McCOSH, Andrew Kirkwood. —Separating condensable matters from combustible furnace gases.

The inventors' prior Specification No. 4117, A.D. 1879, is referred to.

A gas main, which may be connected to several blast furnaces, is provided with a number of "lateral branch pipes, "each of which terminates in a vertical pipe or trunk con-"nected with several subsections constituting one main "section of the separating apparatus. Each main section consists "of a rectangular casing or structure of iron divided into "subsections by horizontal partitions, and in each subsection "hollow boxes or partitions having cold water passing through "them are placed so as to cause the gases to pass by indirect "and circuitous courses through them." There are outlet pipes for collecting and drawing off the matters deposited, while the gases may pass from the several subsections to a vertical trunk and thence to scrubbing-columns, whence the purified gases may be led to a fan and distributing-main. The proportions of the apparatus are regulated so that the movement of the gases may be comparatively slow to promote the deposition of condensable matters, and the directions of flow of the water through the boxes and of the gases through the intervening spaces are generally opposite to each other. Water pipes connect the boxes together, and the passages for the gases are between and alternately above and below the latter.

[*Drawing.*]

A.D. 1880, April 14.—No. 1524.

MATTHEWS, Thomas.—Washing and cleansing ores and the like.

A machine, which may be used for cleansing crushed or uncrushed ores and separating the metals therefrom, comprises a wooden, iron, stone, or other trough, having on its bottom, the inner side of which may be plain or segmental, divisions or spaces. In each division pendulous arms connected together by a framework oscillate to and fro. At the end of each arm is

a paddle, rake, shovel, scoop, harrow, or scraper (sometimes with renewable steel points). Thus the materials are raked or agitated and gradually pressed on by the arms in succession until the process of washing, etc. is finished, and to the outlet of the trough, water being introduced at any desired points. The machine rests on standards or supports, by which its incline may be regulated to suit the work required and materials treated. The framework may be suspended by means of the axles of pulleys or wheels which traverse the upper sides of the trough, or by iron pendulums or connecting-rods and an overhead support, and motion may be imparted by an eccentric or crank arrangement.

[*Drawings.*]

A.D. 1880, April 19.—No. 1606.

LAKE, WILLIAM ROBERT.—(*A communication from John Benbow Jones, Henry Wardwell Shepard, and Robert Seaman.*) —(*Provisional protection only.*)—Alloy ; coating metals.

An alloy, specially adapted for coating iron sheets etc., may be made by first melting in a large crucible in the proportion of from 3 to 6 oz. of nickel ; into the crucible from 3 to 6 lbs. of melted lead are poured, and the two metals are thoroughly mixed. The mixture is then poured into a melting-pot containing from 94 to 98 lbs. of melted lead Into this pot of nickel and lead, from about 50 to 75 lbs. of zinc are put and thoroughly mixed, and then about 29 lbs. of tin. The alloy thus made may be cast into ingots, or be used without re-melting. After the nickel and lead are melted, it is better to introduce the zinc and then the tin in ingots or pieces through a cylinder reaching from above the edge of the pot to near its bottom : the mixing is thereby facilitated. Thus, much lead may be used in combination with the other metals, and yet the alloy will remain sufficiently electro-positive to the iron. This alloy forms a more flexible coating than zinc alone, and the metal bath formed of it is efficient at a lower temperature, other advantages over zinc being indicated.

The sheets or other articles of iron to be coated are cleansed in a bath of dilute acid, washed in the ordinary way, and then placed in a bath of water containing any fusible metallic or organic chlorides of which the bases are positive to iron, and also some of the oxide or surface dross of the metal or alloy

intended to be used as the metal bath. By this means all injurious ferric salts are decomposed, and the free acids contained in the pores after leaving the acid bath are neutralized. The sheets, undried, are then placed in a flux bath composed of water and chlorides of which the salts are fusible at the temperature of the metal bath, thus removing or preventing oxidation as the sheets are transferred to the metal bath. The surface of the flux bath should be covered to a depth of two or three inches with naphthalene oil, or similar fusible substance, capable of combining with chlorine, in a heated condition.

[*No Drawings.*]

A.D. 1880, April 20.—No. 1615.

ALEXANDER, Edwin Powley.—(*A communication from Leon Jules Lancelot.*)—Potassium.

Mineral hydrocarbons are mixed with caustic potash, and heated preferably in a vessel connected to a receiver. The particles of potassium pass over and are collected.

[*No Drawings.*]

A.D. 1880, April 23.—No. 1672.

PETO, Samuel Arthur.—Plumbago crucibles etc.

Referring to the inventor's prior Specification No. 3992, A.D. 1878, the process of rendering the crucible or other vessel damp-proof and non-porous is now simplified. The crucible (which, before baking, generally need not be covered with a compound in accordance with the prior Specification) is, while still warm from the kiln (or after thoroughly re-heating to drive off absorbed moisture), to be dipped in or coated with a compound, consisting of about 6 parts of rosin or analogous gum and sufficient turpentine or analogous spirit to assist in dissolving the rosin, a little tallow or oil being sometimes added. Analogous varnishes may be also used, such as one consisting of about 1 part of pitch, 3 of rosin, and 4 of turpentine. It is well to apply a second coating of the varnish, or of one wherein 5 parts of methylated spirit replace the turpentine. The compound is used in a liquid or heated state. If the heat in the crucible is insufficient to thoroughly dry the coating, the crucible is again warmed.

[*No Drawings.*]

A.D. 1880, April 28.—No. 1735.

STANLEY, JOHN CHARLES WILLIAM. — Utilizing certain waste substances.

Ashpit or dust-bin refuse and other such material is treated in a washer constructed with a perforated false bottom and two exit apertures for the separated materials, one laterally situated above the false bottom and the other formed through the bottom of the vessel below the false bottom. The paper, rags, &c. pass through the lateral aperture ; the mineral matter &c. through the bottom aperture. The straw, wood, etc. are carried over the top of the tank and retained by wire netting or its equivalent, which can be turned back for their removal.

[*Drawing.*]

A.D. 1880, May 1.—No. 1798.

LAKE, WILLIAM ROBERT.—(*A communication from Thomas Southan.*) — " Calcining and deoxidizing ores and other " minerals."

According to this invention (which is described with reference to the deoxidation of iron ores) the pulverized or granulated ore or oxide, intermixed with about 15 p. c. of fine charcoal, may be introduced, by means of a hopper or otherwise, into the top retort of a set (or sets) of (preferably) cylindrical retorts, heated to redness in a chamber, wherein, according to a drawing, the retorts are arranged horizontally. Each retort contains a conveyer, such as a shaft with spiral projections revolving in proximity to the inner surface of the retort, to cause the charge within it to travel gradually from one end of the retort to the other and the particles to change their relative places and be continuously intermixed, so that the whole may be subjected to the same temperature. Beneath the top retort there may be a middle and a bottom retort, wherein the charge is successively and likewise treated as it descends from retort to retort, air being excluded. From the bottom and generally hottest retort, the now reduced ore passes into and through a series of cooling-cylinders, also provided with conveyers and arranged within a water tank, the top cylinder communicating with the bottom retort, and the alternate ends of the retorts and cylinders of each set communicating with each other by passages. The bottom cylinder communicates by a passage with a water trough,

and the water forms a hydraulic seal to exclude air from the cylinders. The gas generated in the retorts has a greater tension than the atmosphere, so that the outflow of the same will prevent the inflow of air, this result being aided by "devices." Sometimes a single retort may be employed. Other carbonaceous matter, such as sawdust, may replace charcoal, or carbonic oxide gas can be used, as it possesses at a high temperature the power of reducing the oxides of iron and other metals. The reducing-gas (which may also consist of carbonic oxide and nitrogen principally, such as is produced by a Siemens' producer) may be admitted into the retorts by tubes or other devices for bringing it into intimate contact with the ore.

[*Drawing.*]

A.D. 1880, May 8.—No. 1886.

HICKMAN, Henry Thomas.—(*Provisional protection only.*)—Firebricks and other very infusible articles.

Especially for gas furnaces a more refractory material than Stourbridge clay is desirable. Some 3 measures of finely-ground ordinary slate (which gives infusibility) may be therefore mixed with 1 of finely-ground clay, preferably fireclay, (which gives plasticity), and water added, the mass being worked, moulded, and burnt like Stourbridge clay in making articles.

[*No Drawings.*]

A.D. 1880, May 11.—No. 1929.

HOWELL, Llewelyn.—Pickling and swilling plates.

The plates are placed vertically in a cradle of yellow metal or other suitable material, formed with two sides either of solid plates or of bars, and with a bottom in which are fixed pins to support the plates. The cradle is carried upon a spindle which rests in bearings upon the sides of the trough containing the pickle or water. The cradle is rocked by a lever fixed on the spindle, and connected by a rod to levers which are rocked through suitable gearing from the crank of an engine.

The cradle is hung by rods from a triangle which may be raised or lowered by the piston-rod of a steam cylinder so that

the cradle may be lifted into or out of the trough. The weight of the triangle and its attachments is balanced by counter-weights.

The trough containing the pickle is preferably oblong and has its ends raised and covered over to prevent the acid or water splashing over when the cradle is rocked.

[*Drawings.*]

A.D. 1880, May 13.—No. 1964.

MARSHALL, Squire.—Stone-breakers etc.

To prevent the crushed stone or other materials from sticking in the usually parallel flutes of the jaws, the inventor makes the flutes of the ordinary pair of jaws wider as they approach the bottom than above; so that the crushed materials readily drop down and the flutes clear themselves.

[*No Drawings.*]

A.D. 1880, May 21.—No. 2070.

STONE, Robert.—Extracting metals from their ores, and burning materials.

Oblong, square, round, or other shaped furnaces (upright, according to a drawing), for extracting metals and for burning lime, cement, etc., have beneath them a space or provision for a large body of hot or cold air or blast to be forced in a powerful volume up through the body of the material operated on. Thus "a broad-cast body of compressed air" acts thereon, as distinguished from the use of tuyeres, and this method may be applied to slightly-modified ordinary kilns, suiting them for burning breeze instead of coke. For smelting purposes the said space contains inclined terra-cotta, fireclay, or like slabs, down which the molten material runs, while refining chemicals or liquids, such as peat or other charcoal, saltpetre, borax, or petroleum, are introduced at one or more points. The material is loaded on fireclay or terra-cotta furnace bars. The blast, after passing over the molten metal on the slabs, acts on the ore being smelted, and the spent blast is used for annealing purposes. The blast "keeps back the scum or surface impurities "from the surface of the flowing metal, allowing the pure "metal to flow into a receiver; from which it may be drawn

" and run into bars or shapes, or into dies, and compressed by " heavy rolls " moving to and fro, " or through rolling mills, " and during such process " a blast is applied under the dies or shapes to aid in annealing the metal. The blast passes from the sides or top of the furnace under floors, which are used for roasting or drying ores, lime, or like materials not to be reduced to a molten state. The inventor dispenses with the inclined slabs, and makes " the furnace bars so that they will drop or " open and discharge the material into the space below." When a natural draught suffices, the furnaces can be built on piers with open spaces around for air to enter. Sometimes there is used " a suction draught from the top of the furnace, or a " forced blast down."

Blocks or brickets, suitable for placing in the burning or smelting furnace, may be made by grinding the ores, lime, etc., using high-speeded corrugated rollers inserted into one another, or a machine resembling millstones with hardened faces of steel or chilled iron inlaid in strips for removal, one grinder preferably running " reverse to the other at different speeds." Also " a drum with rise and fall slips of steel inserted in it to run " against a concave " may be used, or a plain drum may grind against a concave, or a male cone may work in a female cone or cylinder running in reverse directions. The ground material may be moulded with ground peat, coke or coal, clay, etc., in a machine " consisting of a double plunger fitted under a hopper " and worked by cams, one plunger having prior action to the " other, namely, exerting horizontal pressure, and the other " plunger exerting vertical pressure." Again, in a rotating drum, having peripheral recesses corresponding to the shape of block required, pressure may be applied to the material in the recesses by projections on another drum; the recesses have false bottoms, the space beneath which contains lubricating oil. Cams acting on the bottoms may discharge the pressed material, and may also be used in compressing it.

" In removing the slurry or slag from the pits to the drying " floors or under the force pump," a drag is used about as wide as the pit, so that the whole of the slag is simultaneously forced forward. The drag may also " mix the slurry or slag in the " pit."

A blowing-machine is described.

[*Drawings.*]

A.D. 1880, May 25.—No. 2130.

KNOWLES, Sir Francis Charles.—(*Provisional protection only.*)—Reducing mineral or other stones to fragments.

The mineral, when reduced to the size used in lime burning, is heated in a furnace or kiln to cherry redness. It is drawn while heated, and plunged into cold water or quenched with water. The resulting fragments, when cold, are crushed by rollers or otherwise.

If the mineral gangue be carbonate of lime, the operation is aided by the accompanying slaking.

[*No Drawings.*]

A.D. 1880, June 4.—No. 2278.

RAYNES, James William, RAYNES, George Trevelyan, and EVANS, Peter.—Gas calcining-kilns.

The prior Specifications No. 2395, A.D. 1867, No. 3457, A.D. 1874, and No. 5217, A.D. 1878, relating to the same general subject, are referred to.

The smoke and suspended particles or products of combustion are consumed in a combustion chamber, before the heat from the combustion of the gaseous fuel employed is applied for calcination, so that the calcined material is obtained in a purer state. Gas is produced by burning coal and afterwards mixed in the combustion chamber with heated air, which is driven into the coal gas by jets of steam or air passing through heated terra-cotta, iron, or other pipes.

The upright kiln employed is divided by a wall or partition, having a tapered or rounded apex, and carried by an arch, so that the central part of the kiln is divided into two passages, and the material introduced at the top of the kiln is diverted into two streams. Its bottom has "draw bars or false bottoms," and there is sometimes "a vertical opening for the discharge." An air passage is provided for supplying a blast to the bottom of the kiln or to the gas producer. The gaseous fuel is admitted about 25 feet from the bottom of, say, a 60-foot kiln through three passages respectively in the said partition and at the sides of the kiln. Three gas producers may be employed to continuously maintain the heat in the running kiln, and air-heating chambers may be formed on each side of and above the producers,

in connection with pipes for the passage of steam or air (steam being decomposed) and with combustion chambers for the gaseous fuel. The kilns may be built singly or in groups, and the arrangements be otherwise modified.

[*Drawing.*]

A.D. 1880, June 8.—No. 2306.

DICK, George Alexander.—(*Partly a communication from Charles James Adolph Dick.*)—Alloys.

Fusible alloys, consisting of iron or steel, tin, and phosphorus, with or without lead, may be made by heating scraps of wrought iron or mild steel (*i.e.* steel with but little carbon) or iron sponge in a crucible or a tank or bed furnace to a bright red or white heat, and adding tin or phosphuret of tin and sometimes lead, the iron being completely melted down or dissolved. The phosphorus, which renders the alloy liquid during the melting and improves its quality, may be present in the iron or steel employed, instead of using phosphuret of tin In the perfected alloy the phosphorus must bear a proportion to the tin of at least 5 to 100, but must not exceed 2 p. c. relatively to the component quantity of iron, and the tin not exceed 10 to 12 p. c., and the lead, if used, not exceed 6 to 8. A little "silica" and manganese in the iron employed is not injurious. Small quantities of carbon in the alloy require the proportion of phosphorus to be reduced. After the ingredients have become uniformly mixed or combined, the molten alloy is run into ingots or moulds. It may be remelted without practical alteration of its component proportions, and may be cast in sand or chills at a comparatively low heat. Fine castings and bearings or journal boxes may be made of it ; the toughness and ductility are increased by annealing at a red heat. The proportions of the ingredients are varied according to circumstances and the desired results.

[*No Drawings.*]

A.D. 1880, June 9.—No. 2323.

STORER, John.—Interaction and intermixture processes.

The washing of gases charged with metal fumes is among the processes (including of separation) to be effected by causing gases or vapours to interact in the manner described with liquids,

which may have matters dissolved or suspended therein, the gases or vapours being brought into a minutely-subdivided state and forcibly and systematically mixed and agitated with the liquids. A vertical, cylindrical, iron or other vessel is fitted with a central vertical shaft, having one bearing in the bottom of the vessel and another in a frame piece fixed across the top. Within the vessel is fixed by bars a concentric cylindrical shell, the top and bottom of which are respectively below and above the top and bottom of the vessel. At about the middle of the shell, lengthways, a propeller with screw or oblique blades is fixed on the said shaft. By means of a driving-belt and pulley the shaft is rotated and causes the liquid, which fills the vessel up to about the top of the said shell, to circulate either down through the shell and up through the surrounding annular space, or *vice versâ*. The vessel is covered or closed, and fitted with inlets and, if needful, outlets for the gases to be treated : and the velocity of the said rotation (sometimes 1500 or 1600 times a minute) must suffice for the gases to be sucked down along with the central descending current of liquid (when working in that direction), the blades as it were beating the gases into the liquid to obtain the required subdivision and admixture in connection with the circulation. Other forms of propeller, such as centrifugal fans or pumps, may be used ; and they may be variously placed. The propeller shaft may be horizontal : there may be two or more propellers on one shaft : separate compartments or two or more distinct vessels may be traversed by the liquid in succession. Sometimes the gases, instead of entering amongst the liquid from its surface, may be forced through pipes to the neighbourhood of the propeller, or be drawn therethrough by its sucking action. Gases may also interact upon one another.

[*Drawing.*]

A.D. 1880, June 19.—No. 2486.

CARR, Charles, the younger.—Melting-furnace.

Copper, brass, etc. may be melted in a portable furnace with a casing of cast-iron plates, the side plates having legs for supporting the furnace above the ground. The plates have at the bottom projections or brackets, on which a frame rests to

receive a brickwork lining, and the latter may be separated from the casing by a space, containing sand and fireclay or the like to keep the casing cool. For firebars, there are front and back bearers situate below the bottom of the furnace, so that air for combustion may enter all round the bottom as well as between the bars. Thus the combustion will be more vigorous round the sides of the crucible than beneath it, and the sinking of the crucible will be checked. The firebars may be replaced by a continuous cast-iron plate (or the bars may be placed close together) to support the fuel, and air be supplied through horizontal slots in the sides of the casing and lining. Or the slots may be used with ordinarily-arranged firebars ; in this case a layer of coke on the bars supports the burning fuel above and, checking access of air through the bottom of the furnace, ignites very slowly if at all below the slots.

[*Drawing.*]

A.D. 1880, June 29.—No. 2654.

CHICHESTER, Lewis Scudder.—Pulverizing grain, ores, and other frangible substances.

An issuing current of air under great pressure imparts to the substance a great velocity, and causes it to strike nearly at right angles against one or more rigid stationary surfaces with force enough to shatter it into fragments. The fine particles issuing from this pulverizer are received into a large chamber and retained by numerous fine screens. The substance is preferably introduced through a tube, around which is a chamber for compressed air (a pressure of 400 or 500 lbs. to the square inch being preferred) and a nozzle for the jet of air to draw the substance through the central tube and throw it violently against a preferably slightly convex target, placed opposite to the issuing jet. A case around the target encloses the scattering fragments, and presents a surface against which they are brought into forcible contact by the rebound from the target, superinduced by the reinforcing action of the current of air as it passes round the edges of the target ; thus at least two points of impact are presented to the substance. Usually two, and if desired more, targets, cases, and air jets are used in succession to secure the requisite fineness of pulverization. The current of air imparts the requisite speed to the substance to obtain the maximum

effect by the impact upon the target; and the rebound of the shattered particles causes them to enter the current where it is travelling fastest; thus the maximum speed is imparted, and the particles are thrown off by centrifugal action against the inside of the case as the air is compelled to pass round the edges of the target. The mouth of the tube adjacent to the jet orifice is made long and narrow and the jet orifice has a corresponding shape; thus the substance issues from the mouth in a long thin stream and is acted upon by the air issuing from the orifice upon opposite sides, and hence all the particles of substance are acted upon by the air, thrown uniformly against the target, and receive the same shattering effect.

The method of pulverization is not limited to the apparatus described.

[*Drawing.*]

A.D. 1880, July 7.—No. 2793.

JONES, Isaac.—Annealing pots for tin plates.

To give increased durability, the invention consists "in making "the top and sides of the pot in separate parts, having the top "formed spherical in its centre part, or elliptical, spheroidal, or "dome shaped, or nearly so over the entire surface, and adapted "to fit into a trough formed either inside or outside the upper "part of the pot, which trough may be either cast with or "fixed to the pot, or separate and put in loose, or be formed as "a recess between the upper part of the pot and the lower part "of the top or cover." The top of the pot has an internal flange, which is inserted in sand or other material contained in the said trough. There may be slits in the trough to prevent breakage through unequal expansion and contraction.

[*Drawing.*]

A.D. 1880, July 8.—No. 2807.

COWPER, Edward Alfred, and SOPWITH, Thomas.—Recovering lead and other suspended metallic substances from furnace fumes.

The fumes are caused to move very slowly in shallow layers, into which they are subdivided by (preferably) movable shelves whereon the substances become thoroughly deposited.

At the sides of the main furnace flue, numerous small passages branch off at an acute angle and lead into separate depositing-chambers, the opposite ends of which communicate by like passages with another flue leading back to another part of the main flue. By closing a valve or damper in the main flue, the whole of the fumes are directed through the depositing-chambers, and the small inlet of each may be more or less closed by a separate damper, to cause a very slow movement of the fumes through the enlarged area of the chambers, or to exclude them from any chamber to be cleared of deposit. Manholes in the roofs of the chambers admit to spaces for a workman to operate in. Between these spaces the chambers are fitted with numerous shelves, say, sheets of corrugated iron resting on fillets which project from the partition walls. The shelves subdivide the chambers into numerous very shallow layers, so that the suspended matters have to descend by gravity only a short distance in each layer and soon become deposited on the shelves, whence they are removed at intervals. The slowness of the current of fumes prevents the scouring or carrying forward of the suspended matters.

[*Drawing.*]

A.D. 1880, July 13.—No. 2890.

WIRTH, FRANK.—(*A communication from Heinrich Hochstrate.*).—Washing and separating ores etc.

In connection with the prior Specification No. 3353, A.D. 1878, a water basin may communicate with a clearing-pool, the level of the water being maintained by an inlet and an overflow. Several pipes receive water in connection with different apparatus, each being arranged for an extra size of material. Each apparatus has an extra spout, by which the necessary water pressure for each size of material can be regulated. "The "lumpy material, carried forward on the endless band," falls into the apparatus and sinks in the water according to its specific gravity: it meets the upward flow of water, by which the smaller pieces are carried up and over a spout to an elevator The height at which the spout is fixed regulates the water and thus the specific gravity (size) of the pieces carried over. The larger or heavier pieces sink through the water into a connecting pipe, situated under the water apparatus, and provided with an

endless screw or other arrangement to take these pieces away to a Jacob's ladder. The level of the water in this elevator (Jacob's ladder) is the same as in the basin, so that, in each of the spouts of different heights, the speed of the water corresponds to the difference of each spout from the constant water level and to the pressure caused thereby. The size and height of the water apparatus are settled experimentally and according to the size of material to be treated. The elevators have holes, so that the water falls back into a " hopper." The thick water passes from the hopper into a channel, and is pumped or otherwise raised into the clearing pool. The water level in this pool is the same as in the basin in which the pressure pipes (*i.e.* the first-mentioned pipes) are situated, so that if enough clear water does not enter, water from the clearing-pool takes its place, a grating preventing the entrance of floating pieces. " When " the blowing-apparatus stops," the pressure pipes are closed by valves.

[*Drawing.*]

A.D. 1880, July 14.—No. 2899.

GORMAN, William.—Metallurgical furnaces.

Coal, wood, or other fuel or combustible refuse may be filled into upright chambers, having at the base grates, tuyères, or openings for supplying air, hot or cold, or mixed with steam or carbonaceous gases, for combustion. The heat thus generated at the base of the column of fuel ascends, and, by providing outlets at suitable heights (the top of the chamber being closed), " the products of combustion or partial combustion of " the solid part of the fuel " may be withdrawn a little above the said openings, " the permanent gases of the fuel " at a higher level, " the condensible oil and tar gases at a still higher " level, and the aqueous and ammoniacal gases at the top, " so that the several products can be separately utilized. Thus, the gases produced by the combustion may be burnt for heating reverberatory or other furnaces or for heating air, and the permanent combustible gases may be likewise used. When coke or charcoal is to be produced, air is supplied near the place where permanent gases are evolved to burn part of them and produce heat for carbonization. The heated products of combustion, after descending, may ascend through external flues in order to assist in expelling gases from the fuel, or they may

be forced downwards through the fuel for its carbonization, forming combustible gases for heating purposes. "The above "means of carbonizing fuel and utilizing the gaseous products "are applicable to the upper parts of blast furnaces, wherein "the fuel is carbonized by burning part of the permanent "gases." The "products of the combustion descend and "escape from the furnace, together with the twyer gases at a "suitable height." The ores and flux may be filled into passages surrounding the fuel chamber, and the mixed gases may ascend therethrough to reduce the ores. Part of the gases may be led into other passages containing blast pipes, and be injected into the fuel chamber and burnt by the blast to increase the heat and reducing-gases. In another furnace the ores or metals and flux are filled into the fuel chamber, the surrounding passages being in some measure replaced by an annular gas chamber. This furnace or apparatus "may also be used for "converting fuel, either by blast," or a grate may be provided for burning solid fuel upon. Again, gas from other sources may be used in some furnaces.

The fuel chambers described or "fuel converters" may be "worked by blast or draught, and applied to heat furnaces or "chambers, placed in conjunction or separately, in which metals "are heated or melted, or ores are smelted." Also metals, slag, fluxes, etc. "may be filled along with the fuel into the "converter, and being fused may flow into the bottom of the "converter and aforesaid side chambers" and aid in smelting or melting the contents of these chambers; and the fused metals may be run out (from the crucible of the furnace) into hearths, ladles, or pots and be kept hot by gases from the converter for further treatment. When only metals are to be melted, the gases passing into the side chambers may be burnt by admitting a blast. Reverberatory furnaces may be in place of the side chambers.

By using the converter, "metals or their mixtures or other "fusible substances, such as those used for bronzes," may be melted in "crucibles contained in a casing which may be lifted "for pouring;" or if the crucibles are large, the metals are tapped, ladled, or lifted out. The melting or smelting takes place in closed vessels out of contact with burning fuel or flame. The metals, ores, etc. are filled into an externally-heated upright chamber (according to a drawing) and are raked out at

its bottom into the crucible by tools introduced at a door. The cylindrical casing containing the crucible and supporting-walls and lining may be removable for repairs or pouring out the metal, and the crucible can be built up of several pieces.

A double reverberatory furnace has a fuel converter and two hearths, beneath which air for the partial combustion is heated, projections on the bottom plates of the hearths increasing the heating-surface ; while air to burn the converter gas is heated in passages over the furnace roof, the resulting flame heating first a lower and then a raised hearth, connected together by a gutter. Each hearth may sometimes be separately heated, and scrap may be heated in the lower hearth, before it receives the molten metal from the other.

Heat-restorers, for heating air for combustion as by means of the waste heat of the furnace, may comprise refractory clay tubes or passages, through or over which the air and hot waste gases are respectively passed. The hot gases preferably pass through the passages in a downward direction, and the air enters the bottom series of passages and rises upwards towards the top of the apparatus ; but the air and gas currents may take other directions as needed. The passages are tubular or of other section with oblong or other flanges at each end and at intervals ; "so that when the tubes are placed alongside, the spaces "between them form a series of passages external to the tubes "so that whilst the hot gases pass down through the tubes or "passages the air may be caused to cross and recross the tubes "or passages, resulting in an upward direction ; or the hot gases "may pass downwards outside" the passages and the air pass "through one series of passages and return through another "alternately in an upward direction." Brickwork supports the passages, when horizontal, throughout their length, and is "formed of wedge shaped bricks arranged so as to have the "bearing properties of an arch, with openings corresponding to "those of the passages to permit the escape of the waste "gases." The passages may be placed vertically and be "joined by sockets or flanges, so that gravity will assist in "keeping the joints close together." The restorer may be placed above ground at the end of or above a reverberatory or other furnace, as in direct connection with its chimney. Again, the restorer may be heated by burning combustible gases therein.

"To obtain the whole heat from the fuel at once, it is "burned on a grate in an enclosed furnace, and the air for the "combustion of the gases is heated by a series of gills or plates "placed in front of the fire and supplied over the fuel." Valves, worked by automatic or other means, regulate the passage of air respectively through and over the fire to ensure complete combustion with the least air.

[*Drawings.*]

A.D. 1880, July 15.—No. 2915.

JOHNSON, JAMES HENRY, and HAYDOCK, WILLIAM.—Sorting ores, coal, etc.

To assist the pickers by machinery when two or more kinds of mineral, such as rich ore, poor ore, and gangue, have to be separated, sorting-tables, receiving the rough material from a spout or otherwise, may slowly revolve while the sorters sort the various qualities into the different zones of the table, each of which (if more than one) may be emptied separately by stationary scrapers. A perforated table or grating is preferred; around which the pickers stand and sort the coal (the invention being described with reference to coal), throwing one variety on to the raised centre of the table. The table may revolve beneath stationary or adjustable scrapers, which automatically scrape off the various qualities into their respective wagons. The slack, falling through the table, will collect on a shelf below, whence it can be scraped off. Sometimes instead of or as well as the raised centre, there may be a central hole or hopper with a raised edge to receive any stones, gangue, or other material separated from the rest.

[*Drawing.*]

A.D. 1880, July 15.—No. 2918.

McMURTRIE, JOHN McLEOWNAN.—(*Provisional protection only.*)—Alloy.

An alloy, for use as bell metal, and to replace silver, nickel, or electro-plated articles, and taking a brilliant polish, may be made in different qualities by melting and admixture of from 45 to 60 parts by weight of refined copper, 20 to 30 of zinc, and

18 to 25 of nickel, with 2 or 3 of lead, if desired, when the articles are to be turned. The copper and nickel are melted together in a crucible to combine them, and the heat is reduced. The zinc is, or zinc and lead are, added cold with a little potash, soda, and borax, the whole being covered with powdered charcoal. The temperature is then rapidly raised, and, after stirring and skimming, the mixture is cast into moulds to the desired forms, or into ingots for subsequent use, in which case allowance is made for waste of zinc in remelting.

[*No Drawings.*]

A.D. 1880, July 21.—No. 2998.

PARSONS, Perceval Moses.—(*Provisional protection only.*)—Casting ingots etc. of copper, and bronze, brass, yellow metal, and other alloys of copper.

To obtain greater strength and soundness, pressure is to be applied to the metal, while fluid or soft, in the mould, which is made of strong cast iron, wrought iron, or steel. For casting plain ingots, the mould is preferably made cylindrical externally, and slightly conical or tapered internally, with a hole at the bottom, which is closed by a plug, and through which a drift or plunger is afterwards inserted for forcing the ingot out of the mould along with the plug, the conical or taper form facilitating this. The taper may be reduced to nothing in a very short mould with smooth surface. For producing long ingots perfectly cylindrical or parallel, the slightly-conical mould may be provided with well-fitting lining pieces of the required form, which are driven out of the mould with the ingot.

The moulds, having their parts properly fitted together, are placed under a hydraulic or other press, exerting a pressure of several tons on each square inch area of the plunger, which fits the mouth of the mould and is forced in, after the metal has been poured into the mould.

The surface of some copper alloys, in fusion, particularly those containing much zinc, rapidly oxidizes and dross accumulates. To prevent the latter entering the mould, the crucibles used in casting may have a lip, provided with an aperture, through which the clean metal passes, while the lip stops the

floating dross. The lip may form part of the crucible, or be made of sheet iron and held in place by a clip or otherwise.

The invention extends to making other castings, including tubular ingots.

[*No Drawings.*]

A.D. 1880, July 21.—No. 3009.

CLARK, ALEXANDER MELVILLE.—(*A communication from Jules Garnier.*)—(*Provisional protection only.*)—Nickel and its alloys.

To prevent the hurtful action of occluded oxygen, the presence of which makes fused nickel brittle, a substance having a strong affinity for oxygen and for nickel, without injuring the latter, must be incorporated with the melted nickel. Phosphorus is to be employed in quantity proportioned to that of oxygen absorbed. Nickel combined with phosphorus is very white, but slightly puffy, and melts at a lower temperature, whence it can be moulded in sand without fear of adherent particles.

The phosphorus is added as phosphuret of nickel, rich in phosphorus, and prepared either in a crucible on a slab or in an oven provided with a basin. Or it may be added pure, or mixed with other metals. Or a phosphate may be mixed with oxide of nickel before its reduction by carbonized substances: or the phosphate may be added in the first operations for smelting the oxidized minerals, such as garnierite, either for nickel or carburetted nickel. Nickel thus prepared can be easily worked hot or cold.

Nickel combined with phosphorus will produce some very homogeneous alloys with iron, which may also be made from a mixture of pure nickel and "phosphorous irons, not sulphurous."

The phosphorus nickel may be used for alloys of nickel with various metals. Pure nickel for the manufacture of maillechort should contain a larger proportion of phosphorus, which serves to improve the brass employed by deoxidizing it.

[*No Drawings.*]

A.D. 1880, July 24.—No. 3043.

GLASIR, FREDRICH CARL.—(*A communication from Theodor Fleitmann.*)—Coating iron and steel with nickel alloys by welding.

Relates to further applications of a "plating" process described in a former Specification No. 5127, A.D. 1879. The inventor finds that, in addition to nickel, alloys of this metal with zinc, copper, or iron (up to 50 p. c. of the latter) may be united to iron or steel by the process. The iron and the alloy to be united to it are protected from oxidation while being heated by wrapping them up in thin sheet metal; the union is effected by a "hammer or by rolling," the wrapping being subsequently removed by chemicals or otherwise. When the wrapping is thin sheet iron it may be dissolved by dilute sulphuric or muriatic acid. "By this process various sorts of sheet metal "and wire may be produced."

[*No Drawings.*]

A.D. 1880, July 24.—No. 3048.

ENGEL, Friedrich Hermann Felix.—(*A communication from Theodor Schnitzlein.*)—Manufacture of foil.

Foil of tin, zinc, lead, and alloys of these metals may be produced by passing the molten metal between iron or steel rollers, placed in pairs, either in horizontal or vertical position, beside or above each other. The space between the rollers may be so adjusted as to obtain a foil of the desired thickness by one passage of the metal through them. The diameter and speed of revolution of the rollers varies with the melting-point of the metal employed, and their temperature is regulated to suit different metals. The metal may be directly poured on to the rollers, or be led thereto through a channel from the melting-stove. Two channels may supply different qualities of metal between the rolls to make faced or superposed foil. When the rollers are placed one above the other, the metal must be introduced between them by a slope or other mechanism. Superior foil of unlimited length may be economically produced.

[*No Drawings.*]

A.D. 1880, July 27.—No. 3096.

LINDBERG, Leonard Magnus.—(*Provisional protection only.*) —Furnaces.

A furnace for melting and treating iron may have a casing of iron plates lined with refractory material, and a bed or hearth

rammed of refractory material. There are openings for charging, taking out samples, tapping the refined metal, and connecting the furnace with gas and air regenerators. A "focus-flame," produced from rich gas and air for its combustion, is directed with great velocity against the surface of molten metal on the hearth, removes the slag therefrom, and acts by concentrated heat and oxidizing power. There are air and gas channels, and the air blast is directed with sufficient velocity through the gas and into a common conducting-tube, whereby the mixing becomes intimate and the combustion perfect. "By increasing or diminishing of the pressure on "the gas and air," the flame may be made oxidizing or reducing.

[*No Drawings.*]

A.D. 1880, August 3.—No. 3181.

JOHNSON, JOHN HENRY.—(*A communication from Pierre Manhes.*) — Manufacture and treatment of copper and its alloys.

The treatment of sulphurized copper ores may be simplified by a process based upon like reactions to those in treating pig iron by the Bessemer process, any furnace or retort, but preferably a Bessemer converter, being employed. Without previous roasting, the ore is smelted in a cupola or other furnace to eliminate the earthy matters as a dross or scoria, and to concentrate the metallic parts into a matt, containing copper, sulphur, and iron. The molten matt is run direct into the previously heated converter, and the temperature rises as the preferably heated blast passes through the matt, owing to the combustion first of the sulphur and then of the iron and other metals more oxidizable than copper; the sulphur, arsenic, antimony, and other volatile substances being eliminated. The oxidized iron is transformed into silicate by contact with the earthy matters in the lining of the converter, silicious fluxes being added if needful, and the resulting scoria is removed. When the sulphurous vapours have almost disappeared and a sample taken from the converter shows that the crude copper is sufficiently purified to be fined without difficulty, the metal may be run direct into a heated fining-furnace and refined at once. By this process there may be treated not only copper regulus and the like, but oxidized, carbonized, and similar matter

containing copper after being transformed into "crude copper " by simple sulphurous fusion." Copper of good quality may be obtained from materials which ordinarily yield inferior copper. The scoriæ from the converter contain copper as oxide and "slag-cobs." They may be treated in a subsequent operation ; or be separately melted with fluxes in the cupola, yielding black copper and poor dross. The converter scoriæ, being rich in oxide of iron, may be used as fluxes for ores and quartzy matters. When matts containing much iron are treated, the scoriæ would greatly corrode the ordinary earthy lining of the converter ; which should therefore in such cases be lined with lime, magnesia, or like basic material : and silicious flux, to scorify the oxides produced, is added to the matt in the converter.

The crude copper may be refined in the converter itself. Its chemical condition is first ascertained by examining the fracture of a sample. When the reddish-violet coarsely-granulated fracture indicates the presence of protoxide, it shows that foreign matters have been completely eliminated, and the protoxide is then to be reduced. If, however, this indication be absent, the blast is started again, the progress of oxidation watched by taking further samples, and the copper quickly freed from its last impurities. If the last matters to be eliminated will not serve as fuel for intermolecular combustion, the copper would set in contact with the blast. To prevent this, a little powdered sulphur may be carried in by the blast to be burnt for maintaining the heat and eliminated as sulphurous acid ; it does not noticeably check the oxidation of the other metallic materials, the air being in excess. Pulverized charcoal or coal might be also used, but has a reducing action. To render the copper malleable by reducing the protoxide present, the bath is again skimmed and its surface covered with pieces of charcoal ; then the blast is made to carry into the converter much pulverized charcoal, which, besides reducing, raises the temperature sufficiently for completing the operation. When the reduction has progressed considerably as shown by samples and the copper takes a closer or finer grain and paler colour, the converter is placed horizontally, the blast is stopped, and the fining is finished, as in an ordinary furnace, by means of a rod of green wood. All kinds of previously-melted crude metallic copper may be thus refined in the converter. By

previously adding sulphur or by using pulverized sulphur or carbon with the blast, bronze, brass, and other kinds of crude copper, containing neither sulphur nor iron, may be refined.

When poor matts are treated, black copper is refined, or crude copper is fined, a substance is introduced to serve as molecular fuel and maintain the requisite temperature. In preference to sulphur or coal dust, some manganese, "silica," or phosphorus may be employed, and may be incorporated with the materials treated in various ways. Thus cast iron, rich in manganese, silica, or phosphorus, may be used, the iron and carbon thereof increasing the elements of intermolecular combustion. This cast iron is preferably melted separately, and poured into the converter when the temperature begins to fall. Phosphorus is preferable to manganese because it will produce a higher temperature, and to silica (such as highly silicious cast iron) because its use is easier and more economical. When using these reagents, non-sulphuric materials need not be sulphurized before treatment.

The tuyères should open into the converter (or other apparatus employed) at a height level with the place to be occupied by the copper which is to be produced, so that the metal, as it sinks to the bottom and collects, need not be further subjected to the blast.

[*No Drawings.*]

A.D. 1880, August 3.—No. 3183.

ALLPORT, Charles James.—(*Provisional protection only.*)—Making the joints of moulds for casting steel and other metals under pressure.

The inventor uses "strips or rings of asbestos millboard or "asbestos fibre, made into a gaskin between the bottom of the "ingot mould and the bottom upon which it stands, and the "lid and top of the mould," and also between the joints of the different pieces of the mould, if so made.

[*No Drawings.*]

A.D. 1880, August 13.—No. 3295.

WILLIAMS, Silas.—Annealing-pots.

The lid of the pot is cast separately from the case, and when desired to form the joint, it is done by means of fireclay, and

the lid is fixed to the case by bolts, which are passed through lugs arranged to permit of expansion and contraction : the lid is thus secured airtight. The interior of the lid has brackets or ribs to support it and prevent cracking when heated. There is a band round the pot or case to prevent its buckling and collapsing.

[*Drawing.*]

A.D. 1880, August 16.—No. 3321.

WISE, WILLIAM LLOYD.—(*A communication from Bernard Röber.*)—Metallurgical furnace.

Apparatus for burning fuel, which is received first upon a fore grate or hearth where partial combustion and evolution of gases occur, and which is driven along until it enters a secondary furnace or generator, is described, as well as applications or modifications thereof. In one case a melting-furnace takes "the place of a generator with the combination of a front "grate plate and with the arched hearth thereto belonging, a "pit for giving a preliminary heating to the fuel and carbon-"ising or igniting it, and serves either to roast or to heat the "ore. For certain processes the coal is carbonised together "with the ore. The carbonic oxide which escapes from the "furnace meets in its way the material arriving : the gases "from the furnace are used for the purposes named, or a "portion of the fresh fuel arriving." The said gases "with "those yielded by the combustion for preliminary heating," etc., may be taken off together or separately as shown by a drawing, which represents apparatus apparently in connection with the upper part of a blast furnace.

[*Drawings.*]

A.D. 1880, August 19.—No. 3374.

SIEMENS, CHARLES WILLIAM.—Gas furnaces.

A regenerative furnace, described with reference to drawings, has a gas producer, which is of conical form in its lower part and is gathered in above its middle. The producer has an opening at the bottom with a dish to receive the cinder, which may be cooled by water. It also has a central air supply pipe, extending either upwards from the bottom or downwards from the top, and a hopper for supplying fuel has removable covers.

The gas produced passes by lateral openings to a flue leading to the furnace chamber, where it meets heated air rising through a shaft from a regenerator, the flame entering the furnace through a throat and beating down upon its bed. The products of combustion leave the furnace by lateral openings and exit flues, and are conducted along alternate narrow spaces between vertical metallic plates (or thin brick walls) to the chimney. Air, traversing the other alternate spaces, becomes heated on its way to the said shaft, while air to supply the producer is heated in pipes in the exit flues. A steam jet may be used in connection with the air supplied to the producer, and a steam boiler (which is described) may be heated by the said products of combustion. Highly-heated comparatively-rich gas may be thus produced, and gas regenerators be dispensed with while obtaining an intense heat by burning the gas.

The arrangements may be modified.

[*Drawings.*]

A.D. 1880, August 20.—No. 3393.

WEDEKIND, HERMANN.—(*A communication from Henry Bollinger.*)—(*Provisional protection only.*)—Refractory materials for forming converter or furnace linings, crucibles, retorts, and firebricks.

Asbestos (chrysotile) or serpentine is employed, with soluble glass to secure plasticity. By regulating the proportion of asbestos to that of serpentine, the refractory nature and strength of the compound may be varied. To facilitate removing the crucibles or retorts from the moulds, the latter are preferably coated with a solution of magnesium chloride or analagous alkaline chloride. The surface of the converter, furnace, crucible, or retort lining should be covered with the same solution, to be dried and burnt on. As a binding-material for the joints of the firebricks, a like composition to the bricks is preferred.

[*No Drawings.*]

A.D. 1880, August 20.—No. 3394.

DE VILLIERS, PETER.—Inoxidizable alloy, also an amalgam.

The proportions of the metals in the alloy may be somewhat varied according to the purpose in view (provided the desired

properties are obtained), but the following proportions are preferred :—(1) 80 parts by weight of tin, 18 of lead, and 2 of silver ; or (2) 90 of tin, 9 of lead, and 1 of silver. The tin is first melted : while it is thoroughly fused, the lead is added in a granular state, and the mixture is slowly stirred, preferably with a dry fir-wood rod. The silver, separately melted, is then likewise mixed with the compound. The fire under the melting-pot is now quickly increased till the surface of the metal has a yellowish tinge. It is then rapidly stirred and run into ingot moulds. Stress is laid on the procedure adopted.

The alloy produced will strongly adhere to iron and steel, and will impregnate them when prepared to receive it by acid treatment described, whereby they are perforated with almost infinitesimally small holes. Of the different metals employed, the tin imparts pliability to the alloy, the silver renders it hard, lustrous, and inoxidizable, and the lead increases its fluidity and power of penetration into the interstices and pores of the iron or steel. To the latter there can be subsequently applied an amalgam, prior to imparting a coating or covering of silver (and sometimes of gold).

The amalgam is compounded of 60 parts by weight of mercury, 39 of tin, and 1 of silver. The tin is first melted ; and pulverized silver is thrown upon its surface and melts somewhat rapidly. The whole is then stirred while the mercury is gradually added. The mixture is cooled in an earthenware vessel. It is then re-heated 3 or 4 times over a moderate fire without stirring. The amalgam is then ready, and is kept in a close vessel and protected from light.

The inoxidizable alloy may be applied to other metals and alloys capable of resisting the heat required, and sometimes it is made of tin and lead alone. The treatment of knife blades is described.

[*No Drawings.*]

A.D. 1880, August 24.—No. 3425.

LAWRENCE, Frederick Louis.—(*A communication from Alfred Camille.*)—Metallic composition.

Brass, nickel, zinc, and tin are employed ; or (dispensing with all zinc) a combination of about 84 parts of copper, 15 of nickel,

and 1 of tin. Wire, drawn from this composition, requires no preparation to prevent oxidation, and is to be used in tufts, instead of bristles or fibre, for hair brushes.

[*No Drawings.*]

A.D. 1880, August 30.—No. 3510.

JOHNSON, JOHN HENRY.—(*A communication from Placide Gaillard, Isidore Haillot, Raoul Radot, and Alexandre Lencauchez.*)—Heat regenerators.

The regenerators of re-heating and melting furnaces may be constructed of rectangular refractory bricks or blocks, with four or other number of vertical holes through the depth of the brick, so that, when the bricks are superposed, each vertical row will form a series of vertical air passages. On two sides near the top the bricks have lateral projections to support fire-clay tiles or slabs, which are placed in tiers between each two consecutive vertical series of bricks (arranged at convenient distances apart); whereby there are formed series of superposed horizontal flues for the passage of the flames and products of combustion from the furnace. The bricks are united to form longitudinal walls or divisions by means of liquid fire-resisting cement, the different superposed rows being preferably arranged to break joint. The structure is carried on a metal or fireclay base-plate, having corresponding holes to those in the bricks, and the apparatus is contained in a fireproof casing or chamber with an orifice at the top for the entrance of the said flames and products, which follow a zig-zag course, traversing the series of horizontal flues, and escape through another orifice at the bottom. There is also an opening at the bottom for the cold air to be heated, which ascends through the vertical passages, and escapes at the top through a passage communicating with the combustion chamber of the furnace. Removable plugs may be fitted in the end walls of the chamber for cleaning out the horizontal flues. Simplicity, economy, efficiency, and durability are stated to result.

[*Drawing.*]

A.D. 1880, September 1.—No. 3539.

STORER, JOHN.—Interaction and intermixture processes.

Improvements on and developments of the inventor's prior

Specification No. 2323, A.D. 1880, are described, the washing of gases charged with metal fumes being among the processes to be effected. Partitions, deflecting-plates, contracted passages, etc. may control and retard the circulation of the liquid, cause it to offer more resistance to the propelling-instrument, and otherwise aid the process. The circulation may be produced by the same propeller as exerts the beating action, or by a separate instrument. When a propeller on a vertical shaft works in a vertical cylindrical shell with a surrounding annular space for the upward return of the liquid, the inner edge of an annular cover or inverted channel, communicating with an outlet pipe, may dip below the surface of the liquid : used gaseous matters can thus be led away.

To effect the absorption by water of finely-divided matters, suspended in air or gas, and difficult of complete absorption, several propellers may be fixed on a shaft, placed horizontally in a horizontal cylindrical shell in a trough of water. Diaphragms with contracted central openings are fixed in the shell between the different propellers or at other intervals ; or instead of plain diaphragms, there may be sets of blades fixed so as to counteract an excessive forward or whirling motion. The gaseous matters are forced or drawn in at one end of the shell and are repeatedly subjected to the beating action on their way to the other end, whereby suspended or soluble matters are completely absorbed or condensed. Sometimes the upper part of the shell is made oval, and a longitudinal plate is fixed in the upper part to check the tendency to whirling motion.

By this invention lampblack and other products, obtained as a light and fine powder or fume, may be at once condensed and combined with water, and be collected as a paste or mud, from which the water is easily separable.

[*Drawing.*]

A.D. 1880, September 1.—No. 3554.

PARRY, Edward, and COBLEY, Thomas Henry.—(*Provisional protection only.*)—Manufacture of earthy silicates, for making fireproof bricks and other purposes.

A mixture of, say, 100 parts of sand or silicious substance, 60 of furnaced sulphate of soda (salt cake), and 20 of coal

dust may be burnt on the hearth of a furnace or in a glass-maker's pot; when the silicate is formed, it is run into a receptacle and a jet of steam thrown upon it, while hot, to break it up and render it more soluble; or it may be cooled and then broken into moderate pieces, which are steeped in cold water to soften them for grinding. The powder produced is boiled in water in a boiler at a pressure of from 60 to 70 lbs. under agitation; the resulting solution of silicate of soda, after removal, is treated with caustic lime (milk of lime), or the soluble sulphide of calcium (polysulphide), or caustic magnesia, or a mixture of caustic lime and magnesia, such as burnt dolomite, or a soluble salt of magnesia, such as the chloride of magnesium, to obtain the corresponding silicate of lime or magnesia or the double silicate thereof, the reagent employed being added to the solution until precipitation ceases. To remove all the soda from the silicate, a filter press is employed and steam introduced after the pressing is finished.

The silicate of magnesia is applied as a cement to the silica or sand used in making silica bricks and other fire-resisting goods, the mixed silicate of lime and magnesia being also applicable.

[*No Drawings.*]

A.D. 1880, September 3.—No. 3591.

LONES, Jabez, VERNON, Charles, HOLDEN, Edward, and BENNETT, Ralph.—Making the boxes or bushes of carriage axles.

These are cast from an alloy produced by melting together stated proportions of Carron or Scotch Carron iron, scrap or Bessemer steel, and black manganese oxide. The Carron iron may be replaced by cast iron made from hæmatite or other native "peroxide of iron," or a mixture of equal proportions of hæmatite cast iron and Carron cast iron may be used.

[*No Drawings.*]

A.D. 1880, September 4.—No. 3608.

PARRY, Edward, and COBLEY, Thomas Henry.—Tin and other plates lined or coated with vitreous or similar material.

The plates are coated with a composition consisting of a soluble silicate such as that of soda or potash, to which is added an

insoluble silicate, preferably silicate of lime or baryta ; to render it sufficiently adherent it is mixed with serum of blood, gluten waste, starch liquor, or vegetable or animal albumen. It is preferred to use silicate of lime which has been obtained by double decomposition from polysulphide of calcium, in which a little of the latter remains, or a soluble sulphide may be added to the mixture.

The tin, zinc, or other plates are dipped in a bath of the composition, or the composition is applied with a brush roller or other device ; they are then dried and washed in a bath containing a weak acid such as fluosilicic, carbonic, or boracic acids.

The plates may be made into boxes and used for the preservation of goods or other purposes.

[*No Drawings.*]

A.D. 1880, September 6.—No. 3616.

WILSON, Pierce Butler.—Amalgamators for separating metals from other substances.

A centrifugal machine may be adapted to separating gold and other precious metals from water, sand, and crushed ores. Between the " revoluble " basket and the outer casing of the machine, the inventor interposes a mercury-coated plate to receive the contents of the basket as they are thrown off by centrifugal force. The lower end of the casing terminates in a pipe, through which, after the separating process, amalgam, water, and ore are delivered to a vessel provided with stirrers. The ore etc. for treatment may be introduced into the basket through a trough or pipe, and the amalgam is formed by the projection of the same against the mercury-coated plate. A second basket, conical or otherwise, can be secured in the main basket to better distribute gold over the surface of the plate, and another plate can be located in the bottom of the main basket to increase the amalgamating-surface.

[*Drawing.*]

A.D. 1880, September 10.—No. 3695.

BARKER, John Frederick.—Manufacture of gas for illuminating and heating, and for melting and reducing metals from their ores.

A mixture of lime slaked by water or exposure to the air (hydrate of lime or carbonate of lime) with petroleum, paraffin oil, or other volatile liquid products obtained by the distillation of coal, coal tar, mineral oil, shale, or schist, may be heated to redness in retorts or other receptacles to produce a permanent gas. Ten parts by weight of the liquid hydrocarbons to ninety of freshly-prepared hydrate of lime (which has not absorbed carbonic acid) yield a good reducing or heating gas, which can be used in smelting iron.

When using iron ores containing carbonic acid, such as black-band ore, the carbonic acid thereof may be utilized by roasting the ores in closed vessels and passing the carbonic acid evolved into a retort containing a mixture of hydrate of lime and liquid hydrocarbon; or the unroasted ore may be introduced into the same retort.

Coal slack or coke may be also used in making the gas.

[*No Drawings.*]

A.D. 1880, September 15.—No. 3748.

ONIONS, Charles Hill.—Annealing boxes and pans.

Annealing boxes and pans or bottoms may be constructed with a series of wrought-iron chains or links embedded in the cast iron in the process of casting, in order to prevent breakage from the action of the fire on the cast iron during annealing, and to hold together the boxes and pans should breakage occur.

[*Drawing.*]

A.D. 1880, September 15.—No. 3754.

LAKE, William Robert.—(*A communication from John Benbow Jones, Henry Wardwell Shepard, and Robert Seaman.*) —Alloy.

An improved alloy, specially for use as a metal bath for coating iron sheets etc., to prevent oxidation, may be made (subject to some variation in proportions) by first melting from 3 to 6 oz. of nickel in a large crucible, into which are poured from 3 to 6 lbs. of melted lead, and the two metals are thoroughly mixed. The mixture is then poured into a melting-pot containing from 94 to 98 lbs. of melted lead. Afterwards about from 50 to 75 lbs. of zinc and then about 29 lbs. of tin are

put into this pot, thorough mixture being facilitated by introducing ingots of zinc and of tin, successively, through a cylinder extending nearly to the bottom of the pot. The alloy produced may be cast into ingots Thus, much lead may be used with the other metals, and yet the alloy remains electro-positive to the iron or nearly so. This coating is preferable to zinc in regard to flexibility, and as regards the effect on the durability and tenacity of the metal coated.

[*No Drawings.*]

A.D. 1880, September 20.—No. 3813.

DUNKER, JOHN PETER.—(*Letters Patent void for want of final Specification.*)—Extracting gold and other metals from silicious, aluminous, and other substances; and obtaining aluminium bronze from aluminous residues and clays.

To obtain gold, the quartz or other containing substance is smelted with a flux, consisting mainly of soda ash or potash, or both, and with carbonaceous matter like charcoal. When the substances are melted, metallic copper (say, precipitated copper) and zinc are added with the view of developing electricity. Thus the gold is brought to the metallic state, and may be purified as usual. Silver and other metals may be likewise obtained from ores etc.

Aluminium bronze may be likewise obtained from dried and ground aluminous residues etc. The aluminium is brought to the metallic state and combines with the copper to form aluminium bronze.

The smelting may take place in crucibles or other apparatus or furnaces.

[*No Drawings.*]

A.D. 1880, September 21.—No. 3822.

CLAPP, WILLIAM JOHN.—Manufacture of metals.

The apparatus described is primarily intended for converting crude iron into malleable iron or steel, but may be used in the manufacture of other metal when advantageous. A mixing, puddling, or refining chamber is suspended in the centre of a furnace or heating-flue, and comprises two parts, which are fixed together by means of inclined or conical flanges, formed thereon

in a plane by preference slightly inclined from the horizontal. The upper flange forms a trough round the chamber to receive (from another trough) the molten metal for treatment, which thence enters the chamber through an opening in its crown. The lower flange rests upon a seat formed in the furnace. The upper part of the chamber is connected to the crown or cover of the furnace by a tube, through which passes the shaft or axis of a stirrer for agitating the metal within the chamber, the shaft being conveniently rotated by bevel gearing at its upper end. The interior of the upper part of the furnace is formed slightly conical, to permit of the ready insertion and withdrawal of the chamber and stirrer by lifting-tackle. The lower part of the chamber has a tap hole for running the molten metal, after treatment, into a trough in the lower part of the furnace, whence it may be removed. Again, the chamber may have apertures to fit against tuyères or pipes, when a blast of air or steam, or both, is to act on the contents of the chamber, an opening being then left in its crown for the escape of gases.

In a modified arrangement, the chamber is supported by a flange resting on the cover of the furnace, and the crown of the chamber contains an aperture for running in the molten metal, the conical flanges being dispensed with.

By using purifying-agents or by mixing various materials with the metal or different descriptions of metal together in the chamber, various qualities of iron, steel, and other metals can be produced, including a homogeneous metal free from bubbles.

[*Drawing.*]

A.D. 1880, September 23.—No. 3864.

NEVILL, William Henry.—Annealing iron and steel.

To aid the annealing process, the metal is submitted, before or after being rolled into sheets, and sometimes while heated, to screw, hydraulic, or other pressure, which is continued while the metal is being heated, and sometimes until it has subsequently cooled. A number of sheets may be compressed between two plates, through holes in which bolts are passed to be secured when the pile of sheets has been compressed. The pile, in the state of a solid block, is then heated with or without an iron cover in an annealing-furnace, and the effect of the heat is

much greater than usual: the sheets become softer, fewer waste sheets are produced, and less tin is required when they are to be tinned. Bars or pieces of metal may be likewise treated..

[*No Drawings.*]

A.D. 1880, September 25.—No. 3884.

GROTH, LORENTZ ALBERT.—(*A communication from Aug. Gillon.*)—(*Provisional protection only.*)—Casting zinc, copper, pewter, etc.

The molten metal is poured into a reservoir or cylinder, provided with a piston in communication with hydraulic, steam, or other power. The metal is driven or compressed by the pressure of the piston into the moulds, and the pressure is afterwards continued while the metal is still in fusion. "The "pressure will produce upon the metal the same effect as that "of a powerful hammer." The moulds and pipes may be made of two pieces joined by a cramping-frame.

[*No Drawings.*]

A.D. 1880, September 25.—No. 3885.

MORGAN-BROWN, WILLIAM. — (*A communication from Alexander Graham Bell.*)—Treatment of selenium.

Ordinary fused selenium has a high electric resistance, and is but slightly sensitive to or affected by rays from the sun or similar sources. When this selenium is gradually heated to about 117° C., it undergoes a structural or molecular change; a sort of cloudiness passes over its surface, which looses its dark colour and lustre and assumes a bluish colour and rather dull appearance; its electric conductivity also is suddenly increased, as a galvanometer in circuit with the selenium will show. The conductivity continues to increase as the temperature rises to about 207° C., at which the selenium is about to fuse (but must not actually melt). Thereupon the source of heat is removed or the selenium otherwise allowed to cool so that it may possess the desired conductivity and sensitiveness, the process being sometimes repeated. The change, from increase to commencement of decrease, in the deflection of the galvanometer needle indicates the moment for stopping the heating, which may be

also known by the surface becoming dark and losing its metallic lustre. Large masses of selenium may be treated in a closed chamber to ensure uniform heating by a suitable source of heat. The chamber may have windows for observation, and a thermometer may indicate the approach of the critical moment. The treatment is described in connection with the use of selenium in telephonic apparatus.

[*Drawings.*]

A.D. 1880, October 4.—No. 4016.

FLETCHER, JOHN.—Melting furnaces.

To expedite the melting process and partly utilize the waste heat in furnaces for melting brass and other metals or alloys, particularly in the furnace to which the inventor's prior Specification No 441, A.D. 1877, relates ; a supplementary chamber for the preparatory heating of the metal or alloy is to be applied to the upper part of the furnace, and the heated products of combustion flow through this chamber before leaving the apparatus.

For the cover of the melting-furnace to which the prior Specification relates, there may be substituted a heating-chamber, having a metal shell with a refractory lining like fire-brick. Some bricks, of one of the rings of brick forming the lining, may project inwards beyond its general surface and sustain the crucible in which the metal or alloy is heated. The chamber has a projecting arm, wherein is secured a hinge pin turning in a seat, which is formed in a projection upon the outer shell of the melting-furnace. To the upper part of the chamber is fixed an outlet elbow pipe the lower end of which should turn smoothly within another elbow pipe or conduit, bolted by the aid of a bracket to the melting-furnace. The axis of motion of the first-mentioned elbow pipe should coincide with the axis of the hinge pin. But the elbow pipes may be dispensed with when the products of combustion need not pass into a chimney. During the melting of one charge in the furnace, the heated gases therefrom rise into the chamber and surround the crucible therein containing another charge. The chamber can be turned bodily upon the hinge pin to uncover the mouth of the melting-furnace. When the melted metal has been poured, the crucible heated in the chamber is placed

in the furnace, and a crucible containing another charge may be placed in the chamber to be heated. The chamber has a refractory-lined cover, which may rest upon a faced joint ring, as in the case of the chamber itself, and turns upon a hinge.

[*Drawing.*]

A.D. 1880, October 5.—No. 4031.

JONES, HENRY, and HOLT, ELI.—(*Provisional protection only.*)—Puddling-furnaces.

To cool and preserve the bottom, flue, jamb, and back plates, the bed of the puddling-chamber has two bottoms, a lower or false bottom and an upper or true bottom, the bottoms being parallel to one another and a short distance apart with a flat air chamber between. The false bottom is supported upon pillars or masonry, and the true bottom " upon notched longitudinal " bearers on the false bottom. The ends of the false bottom " are perforated," so that blast may " enter the perforated flue " bridge end of the bed and pass into " the flat air chamber, and " from thence to the perforated fire bridge end." The flue bridge is hollow or tubular and communicates with " an air " passage in the flue bridge end of the bed." The ends of the flue bridge open into " passages made between the jamb plates " of the bed and the sides of the furnace," and air circulates therethrough. The firebridge is also hollow, and is perforated to supply air or blast to the fireplace of the furnace. The fire-bridge communicates with the " perforated fire bridge end of " the false bottom," and its ends open into flues in the side walls of the fireplace, and through perforations or slits therein jets or sheets of air may be supplied to the fireplace. " Opening " into the perforated flue bridge end of the false bottom is a " chamber supplied with air under pressure." The blast passes partly through the flat air chamber and partly through the hollow flue bridge and side flues, and, becoming heated, is delivered partly into the back of the fireplace and partly into its sides. Thus, a vigorous and perfect combustion is ensured with economy of fuel. A perforated plate, inclined inwards, supplies air to the fire place at the front. One end of the hollow firebridge is open to the atmosphere and has a slide or

damper, by adjusting which a part of the blast may be permitted to escape and the quantity entering the fireplace be controlled. Slack or small coal may be used.

[*No Drawings.*]

A.D. 1880, October 5.—No. 4051.

LAKE, WILLIAM ROBERT.—(*A communication from Thursten Gordon Hall and George Henry Van Vleck.*)—Smelting ores, chiefly for producing steel and recovering precious metals.

Gas, chiefly a mixture of nitrogen, carbonic acid, and carbonic oxide, from the exit passage of a furnace in which coal or other fuel is burnt with free admission of air, is conveyed through the vertical pipes (around which water circulates) of a surface cooler or closed tank, whence, at a reduced temperature so as to prevent causing injury, it is drawn into a blowing-machine, which discharges it through a pipe and "equalizing vessel" into an annular gas chamber surrounding a blast furnace, wherein the ore is smelted with fuel and flux. Another blowing machine supplies air to another annular chamber. These two chambers communicate by descending pipes with two or more rows or tiers of tuyères, each gas tuyère being placed between two air tuyères, while the pipes leading to the lower gas tuyères have cocks or valves to check the flow of gas thereto, when it is desirable to use air alone at the lower tuyères. Also steam from a pipe surrounding the furnace may be led into the lower gas tuyères to mingle with the gas. The mixture of gas and air is injected into the furnace at or below the point at which the metal begins to fuse.

The upper part of the blast furnace communicates by a pipe with a vertical condensing-chamber or column, through which a shower of water descends from a jet, the water being divided by sieves or perforated plates. At the lower end of the column are two branches, leading to separate water tanks placed above a larger overflow tank, while a valve regulates the communication between the column and each branch. The column is open at the top, and the branches are preferably "water sealed" at the bottom.

When ores of precious metals are smelted, the high temperature in the furnace "sublimates or vaporises the precious "metals;" which pass off with the gases into the condensing

column and are precipitated by the water and collect in the tanks. The sediment therefrom is smelted down with lead in crucibles, and the precious metal is finally obtained by cupellation or otherwise.

Refractory ores may be worked.

[*Drawing.*]

A.D. 1880, October 6.—No. 4062.

RICHARDSON, John.—Treating diamoniferous earth or ore.

Machinery for automatically treating diamondiferous earth, and separating and sorting the diamonds found therein, designed to decrease the manual labour and prevent loss of the diamonds by theft.

The earth is tipped into the mouth of a wrought-iron or steel casing, and falls between a coarse grating. It is then pulverized and disintegrated by a series of steel knives set at an angle on a revolving shaft, and is at the same time mixed into a pulp with water entering the machine at the hopper end. After passing down the machine, the earth with the diamonds falls through a fine grating into a washing-machine, the stones being ejected by means of a steel screw blade or blades. After being freed from mud the small stones, mixed with diamonds, fall into a hopper which conveys them to a series of three sieves by which they are sorted into different degrees of fineness.

[*Drawings.*]

A.D. 1880, October 8.—No. 4083.

TAGELL, John.—(*Provisional protection only*).—Galvanizing.

A method of driving the rolls beneath the surface of the molten metal in the galvanizing-bath, without disturbing the surface of the metal. A horizontal shaft above the bath, driven by suitable gearing, has keyed to it a bevel-wheel which gears with another bevel-wheel attached to a vertical shaft, the lower end of which actuates the horizontal rollers in the bath, by suitable gearing. The vertical shaft is surrounded for some inches below the surface of the metal by a metal tube, carried on a bracket attached to the frame of the bath.

[*No Drawings.*]

A.D. 1880, October 8.—No. 4094.

ELMORE, William.—Extracting metals (copper and zinc) from their ores, and separating them from each other.

Dynamo-electric machines may be used, such as the inventor's prior Specifications, No. 3565, A.D. 1879, and Nos. 3274 and 3832, A.D. 1880, are stated to relate to, but the secondly-mentioned invention refers to the manufacture of metal plates.

Chloride, sulphate, or other extraction liquors from ores or mixed metals may be treated by the present invention. Thus, after the sulphur has been burnt out of broken cupreous pyrites, for instance, and the finely-ground ore has been roasted with salt and then the chloride of copper dissolved by boiling water, the inventor allows the liquor to clear and runs it off into clean tanks, over the tops of which are arranged connecting-rods from the dynamo-electric machine or other source of electric current. Thick plates of zinc are suspended from the anode rods and thin sheets of copper from the cathode rods. On passing the current, the copper is deposited or thrown down, an equivalent of zinc being dissolved. The liquor is now siphoned into precipitating-tanks (leaving the copper behind), and the zinc is precipitated, as by carbonate of soda or lime, but the inventor proceeds thus :—The liquor is boiled and sufficient chloride of lime is added to combine with the sulphuric acid, some of which is always present, sulphate of lime being precipitated and chloride of zinc left in solution. Sufficient boiling milk of lime is added to the boiling clear solution to precipitate all the zinc as oxide, which is dried and is ready for distillation with coal as usual. The zinc is melted and made into anode plates for re-use, the chlorine being recovered as chloride of sodium or bleaching powder.

The zinc anode, after having been amalgamated, is suspended in a porous cell, which is surrounded by the chloride liquor in the depositing tank, and contains a mixture of, say, 1 part of sulphuric or other acid to 24 of water, the deposition of subchloride being thus prevented. The cell must be charged with fresh mixture as it becomes saturated with zinc, which is recovered as above described. The refuse of amalgamated zinc from the cell is heated in a retort to distil over and recover the mercury. Any zinc in the ore will be found in the chloride liquor and be recovered with that dissolved from the anode.

Sometimes lead or carbon anodes and cathodes may be used, as also zinc anodes and carbon or brass cathodes, or platinum or silver anodes and copper cathodes.

[*No Drawings.*]

A.D. 1880, October 9.—No. 4098.

DICK, GEORGE ALEXANDER.—Distillation, sublimation, etc.

To effect continuous working and avoid the interruptions of ordinary discharging and recharging, zinc ores and various other materials may be treated in distilling-chambers, constructed of one piece or built up of firebrick etc., and arranged horizontally or otherwise. Numerous flues or channels, for the circulation of steam, products of combustion, or other heating-medium to effect the distillation or sublimation, surround the chambers, the outer ends of which have hoppers and screw arrangements, or equivalents, for mechanically effecting and regulating a continuous feed of the materials to and through the chambers; while their inner ends open into evacuating chambers to receive the products of the operation, one evacuating-chamber sufficing for one, more, or all the distilling-chambers. The walls separating the flues from the distilling-chambers are as thin as strength permits. As the materials travel gradually through these chambers, distillation takes place, and the gaseous and volatile products pass into the evacuating chamber and thence escape through openings at its top into any receptacle to be cooled, purified, or otherwise treated. For removing the solid products, which fall into the evacuating chamber, the lower part of the latter has a series of hermetically-closing drawers or doors, which can be opened successively to remove these products without admitting air or interrupting the distillation. By closing the above-mentioned openings, the pressure of the volatile products, thus brought to bear on the solid products, assists their extraction. Liquid products may be likewise removed, or by means of pipes. The distilling-chambers preferably have diverging sides and an inclined bottom, to facilitate the forcing forward of the materials and allow for their possible expansion.

The invention is further described with reference to the use of like chambers as gas-expelling chambers, its scope including the manufacture of coke, distillation of gas, etc.

[*Drawings.*]

A.D. 1880, October 12.—No. 4136.

BARKER, GEORGE.—(*A communication from Albert Harnickell.*)—Separating zinc from other metals.

To produce commercially and cheaply the chemically pure and dense zinc hitherto only obtained in the laboratory, ordinary or impure zinc or zinc dross may be melted to a dull red heat in the reverberatory zinc furnace or in a muffle or kettle to settle, and as much lead as practicable is removed in the usual way. Afterwards there is plunged to the bottom of, and moved about in, the bath sulphur in an iron pipe or vessel perforated with holes, each supplied with a wooden plug held down by a handle. The device of the wooden plugs ensures for all but extremely plumbic or ferric zinc a sufficient prolongation of the infusion of sulphur; other reagents may be likewise used if needful. The brimstone in the presence of iron forms sulphurets, also arsenites, combined of metallic elements present excepting the zinc which is not touched. The sulphurets mixed with some zinc are removed by perforated ladles and subsequently treated again to liquate zinc out of them. The grosser and larger portions of non-zinc elements having been removed, the bath now consists of approximately pure but partly electro-negative zinc, an allotropic form comparatively useless for the arts; but by the further operations this molecular condition is reversed and wholly electro-positive zinc of high specific gravity obtained. The above operation may be dispensed with in the case of silver zinc, lead scum, or other material for which fluxing or kettling would not be economical, but such material should be distilled with a little kettling metal, since traces of iron and sulphur are useful in the retort.

The retort furnace employed comprises a firebox, whence lead the fire channels over bridge walls. The fire passes through combustion chambers, thence through openings over (and sometimes partly beneath) the retorts, and then through other openings on the opposite side of the retorts into passages, which are fitted with dampers, and lead by smoke flues to the chimney. Each retort rests (sometimes by the aid of saddles) upon a hollow pillar wall, which longitudinally divides each retort chamber. By channels leading into the firebox above and below the grate, a hot blast as it were can be supplied to the firebox or let into the retort furnaces through valves

worked by dampers, the air being heated in traversing the channels, and in any event the circulating air cools the masonry. The retorts, each of which can be operated independently, may be 6 feet long by 1 foot interior diameter There is a charging-lip at one end, and at the other a small outlet and a narrow short inclined condensing-pipe with a connected receiver, which is preferably set over the smoke flue. To temper a new clay retort, pipes or flues may be made to connect the interior of the retort with the fire flue and smoke flue, respectively, for simultaneously heating it from without and within to lessen the danger of cracking. Afterwards to close all internal pores and cracks and make the interior resist fused or gaseous metal, so as to prevent leakage and waste, a deposit of graphitic carbon is to be formed on the whole interior of the retort by conducting into it, while white hot, hydrocarbon gas which is kept under pressure and becomes decomposed, the retort receiving a carbon lining and highly-hydrogenous surplus products escaping. Afterwards the retort should remain hermetically closed under the same heat for some time. (This improvement is applicable to other metallurgical purposes as well in distilling as in melting.) The receiver has a slightly-inclined shelf, extending across its whole width, and placed under the opening of the condensing-pipe or channel chamber, which also may be lined with carbon, if made of clay. The shelf, which is also termed a perforated false bottom, has an aperture (at the side of the receiver under the outlet of the condenser) with a small fender to receive the dropping zinc and pass it below without splashing. The receiver has tap-holes near the bottom and just above the shelf. A movable pipe is inserted in the receiver just opposite the channel condenser pipe, with which it accurately registers, so that one continuous pipe channel is made by pushing it inwards. A semicircular partition half closes the movable pipe, and a rod with a semicircular scraper serves with the partition to close this pipe when cleaning it. The end plate of the pipe has a glass or mica window for looking into the condenser and retort.

For the distillative separation of zinc from impurities, the retort is charged at intervals with metal, if fluid, through the lip, otherwise through a hopper, air being excluded from the whole apparatus. The heat is kept at the distilling point of

zinc, and at first, after charging, the movable pipe is pushed in to close the receiver and form the only outlet. This pipe has an outlet valve for the automatic discharge of non-metallic gases. Again, all metals present which volatilize before zinc, including cadmium, antimony, mercury, and sulphur, distil into the said pipe, which is cool, and may be saved separately by keeping the pipe cleaned. When much zinc appears in the movable pipe, it is drawn out till its end is flush with the side of the receiver, into which the zinc now runs from the condensing-channel, and, protected from oxidation, collects in its warm bottom, a great pressure and quantity of zinc being maintained in the retort. Impurities may now lodge on and above the shelf of the receiver or go over into the movable pipe. To check the rising temperature of the condensing-channel, a water jacket is placed round it after a time, so that it will condense all gaseous zinc, while keeping fugitive impurities volatile ; to the same end it may have upwardly-radiating branches, whence condensed zinc flows into the main stem. The receiver is tapped before re-charging, pure zinc being obtained.

This zinc must cool without chilling till the skin with adhering matters can be taken off with one skim, contact with all metal being avoided. The zinc may be cast into ingots. The mould is preferably made of zinc, with a cup to receive the metal as poured, and a wide neck leading to the main mould. The mould is firmly supported in a water or other refrigerating bath in a strong vessel to avoid shaking by ebullition in casting. A skimmer or comb with lugs rests in the neck between supporting notches, and retains dross or oxide as the metal flows beneath. The zinc may be used for alloys, as with copper and nickel, and for other specified purposes.

When treating amalgam of zinc and mercury in the retort, the movable pipe may end in a vessel of water, the heat to be below the distilling-point of zinc, some of which will, however, distil with the mercury and lodge in the receiver, wherein the heat will suffice to continue driving mercury into the cool movable pipe ; this zinc is not pure. When treating material containing much copper, lead, and tin, these residual metals may be tapped out of the retort ; in the case of iron alone, carbon and fluxes may be introduced to melt it at a white heat. In dealing with mixed metals containing iron, after the zinc has ceased to flow, the movable pipe may be pushed into the

condenser and the heat increased to a point which may carry over lead etc., this product being returned to the kettling furnace. The residue in the retort may be scraped out.

After the zinc has all been distilled over from the zinc-silver-lead alloy obtained in Parke's process of desilverizing lead, the lead-silver alloy may be tapped out of the retort and cupelled, while the zinc oxide and dust are collected from the retort and condenser for a final reduction with fine coal in the same retort; the zinc now produced possibly contains gold and silver and is used again in the zincing process.

[*Drawing.*]

A.D. 1880, October 13.—No. 4165.

HARTNELL, Wilson.—Eliminating blue and other diamondiferous conglomerates for the purpose of extracting diamond.

A scoop facing the motion of the horizontal pan of an edge-runner mill receives the pulverized contents thereof, which fall over into a mixer. The scoop has a counterbalance weight, by which it can be raised or lowered. A hopper conducts away the muddy water, and the mixer is provided with water through a perforated pipe.

After the reduced conglomerate is freed from large stones by passing through a sieve, it is then discharged into the eliminator. This consists of a compound cylindrical sieve, supplied with water, and having three or more different meshes, below which are three or more hoppers, and outlet shoots, on to three or more separate horizontal sieves, placed side by side, their mesh being less than that of the part of the cylindrical sieve above. These sieves are mounted on a water tank in which a pulsatory action is maintained by a pump.

[*Drawings.*]

A.D. 1880, October 14.—No. 4179.

GRIFFITHS, William.—Washing ores and other substances.

A rotary machine, described for washing roots, is suitable for washing ores, mineral earths, etc. A hollow drum, or cylinder, is mounted on a horizontal axle, working in bearings so disposed that the lower portion of the drum revolves in a tank of water

or other liquid. The periphery and sides of the drum may be of open wirework, or of wirework in combination with perforated or other metal plates or sheets attached to radial arms, which carry the circular main frame or skeleton of the drum. A spiral or volute-shaped passage leads from the circumference to the centre of the drum above the water level, and along this passage the materials are caused to pass in as the drum revolves, until by the action of the spiral they are gradually brought to the inner convolution of the passage above the water level; whence they are discharged laterally through a central aperture made in one or both sides of the drum and communicating with an inclined delivery spout. The materials enter the drum from a stationary inclined spout or hopper communicating with a corresponding inlet opening in the periphery of the drum; each time this opening passes in front of the hopper, a charge of materials enters the outer convolutions of the spiral. A stop or partition may prevent the materials from being jammed between the periphery of the drum and the outside of the first convolution, should the drum be rotated in the wrong direction. The dirt and refuse fall through the drum into the tank beneath and are removed at intervals, the washing operation being continuous. Helical convolutions of gradually-decreasing diameter may extend laterally from the side of the drum towards the delivery end in lieu of all being in the same vertical plane, the delivery being effected from the side or periphery of the smallest convolution.

[*Drawing.*]

A.D. 1880, October 18.—No. 4244.

COOK, RICHARD.—Pulverizing, mixing, and separating machinery.

Reference is made to the prior Specification No. 1429, A.D. 1875, which relates to pulverizing ores etc., balls or rollers being carried round by a revolving shaft and arms within a circular casing.

The present inventor uses a machine with a cylindrical case made in two halves, which are bolted together, and between which fits a steel or other hard ring preferably made in, say, four segments with a surrounding retaining-hoop, the latter being dispensed with if the ring is in one piece. An injured

segment can be replaced, and the segments may change places to equalize wear, which is greatest at the lower parts of the ring. A driving-shaft, supported in bearings outside the case, has arms to carry the grinding, crushing, or pulverizing rollers or balls, which rotate within the ring. The shaft is placed nearer to the lower part of the case than to the upper, so that the ore, stone, or other material treated is crushed or bruised at the upper, and ground at the lower part of the machine, where the distance between the rollers and ring is less than at the upper part, the disintegrating action taking place between the rollers and ring. By set-screws, passing through the case, the ring can be raised towards or lowered away from the path of the rollers at the said lower part, to suit different materials and vary the fineness of their reduction, and also to compensate for wear; or the ring may be "unadjustable."

The two carrying arms or plates and a flanged central piece, to the sides of which the arms are bolted, are keyed upon the shaft, the construction in separate replaceable parts or castings being preferred. Each arm has a flat central part wider than the ends, and each end has a curved projecting piece, blade, or fan, which partly covers and protects the roller, and which contains a slot to form a bearing for the trunnion or spindle end projecting from the roller. The slots are made long enough to provide for the centrifugal action of the rollers, which fit between the ends of the two arms, and can rotate there and move inward and outward radially. The curved blades or fans agitate, distribute, mix, and, by causing a draught, cool the material: and they force it when sufficiently pulverized through sieves or screens in the sides of the case, whence it passes into a delivery spout, the draught preventing the sieves from becoming clogged, and the sieves being adjustable towards or from the blades to suit the material. A case, without sieves but with an outlet at the upper part, may be used for wet grinding. Again, the rollers may have spindles fixed in the ends of the arms, the spindles passing through proportionally-large central apertures in the rollers to allow for the centrifugal movement of the latter. Also curved or scoop-shaped radial fans or stirrers may be so carried by the said central piece that one fan follows each roller and precedes the other: or sometimes a stirrer with two arms extending on opposite sides of the shaft may be made in one piece to fit upon the shaft.

When using water or other liquid, the machine preferably has three balls or rollers between two discs upon the driving-shaft. The material and liquid pass through a hopper, pipe, and side opening communicating with the central part of the case. The rotating rollers cause the material, when reduced enough, to rapidly ascend with the water into an upper chamber, which has several side openings one above another. A discharging-spout is fitted to one or other opening to suit the density of the material, the openings for the time not in use being closed by stoppers. The pulverized material, escaping through the spout, is afterwards separated from the accompanying water by precipitation. For reducing such materials as brass ashes (the metal of which collects in the case), or minerals like gold quartz or lead, a door for removing any accumulation is provided at the bottom or one side of the case. Sometimes the material and liquid may be fed centrally at the upper part of the machine and discharged through side pipes.

To use the machine as an amalgamator, the rollers are replaced by spirally-arranged or other fans, blades, or paddles for agitating the water, and the ring is removed. Mercury is placed in the lower part of the case, and in pockets or depressions in the spout, or elsewhere. There is a door for removing heavy or large pieces of mineral.

A machine for pulverizing coal, grinding corn, etc. is also described.

[*Drawings.*]

A.D. 1880, October 18.—No. 4245.

STEVENSON, James Cochran, and TATTERS, James Graham.—[*Patent dated 26th February 1881.*]—Treating ores of lead, zinc, and other metals.

1. After being ground and calcined to drive off the sulphur, bluestone and other ores containing the sulphides of lead and zinc, with or without other metals, such as copper and silver, may be agitated with sufficient weak hydrochloric acid to dissolve the oxide of zinc without the other metals. An excess of 30 p. c. of hydrochloric acid (such acid containing from 5 to 10 p. c. of real acid) above the quantity which will combine with the zinc is sufficient. Heat is not applied; very little

copper and practically no iron or lead or zinc is dissolved, and any remaining sulphide of zinc is not attacked. A wooden or cast-iron box or covered cistern, revolving on a shaft which passes through it at two diagonally-opposite corners, and provided with a water-tight charging-door, may be employed. After the operation, the solution and residue are discharged into a vessel beneath to settle, and thence the solution may be run or siphoned. Copper, if present in the solution, may be thrown down by metallic zinc, and then oxide of zinc may be precipitated by lime ; or the zinc may be otherwise obtained. The residue, after washing, can be used for producing lead and silver by ordinary processes.

2. The residue, however (or a like residue remaining after weak sulphuric acid has been employed), may be treated with a considerable excess of strong hydrochloric acid, aided by heat, to convert the lead and other metals into chlorides, and then iron is rendered insoluble by calcination. A similar arrangement to that known as the pan and drier, for decomposing salt by sulphuric acid in alkali works, is preferably used, and the iron pan may be lined with firebricks. The heat of the furnace aids the dissolution and evaporates to a pasty state the chlorides and gangue, whereupon the mass is thrown on to the adjacent hearth, and calcined just enough to drive off the excess of acid and render the iron insoluble as well as the silica. The calcined mass may be treated with cold water to remove any remaining chloride of zinc, which (after precipitating any copper in the solution) is added to the bulk previously produced. Chloride of lead free from iron is then separated by boiling water, solution of alkaline or earthy chlorides, or otherwise, and silver may be separated by known means.

[*No Drawings.*]

A.D. 1880, October 18.—No. 4247.

WISE, WILLIAM LLOYD.—(*A communication from Knut Victor Berg.*)—Furnaces.

A furnace for melting and treating iron may have a casing of iron plates lined with refractory bricks, and a bed or hearth rammed of refractory materials ; or the furnace may be rammed entirely. There are openings for charging, taking out samples, tapping the refined metal, and connecting the furnace with gas

and air regenerators at each end. A "focus-flame," produced from rich gas and air for its combustion, is directed with great velocity against the surface of molten metal on the hearth, removes the slag therefrom, and acts by concentrated heat and oxidizing power. The igniting-blast of air may be directed with sufficient velocity through the gas and into a common conducting tube, whereby the mixing becomes intimate and the combustion perfect. The gas and air channels may be modified in different ways ; only part of the air may be heated in regenerators, or the gas may be taken directly from the producer and be ignited by cold or hot blast. Again, pressure may be used for either the air or gas, the other being introduced by suction, or the pressure may be dispensed with by using a chimney shaft or equivalent. "By increasing or diminishing the pressure on the gas and air," the flame may be made oxidizing or reducing.

The furnace may be stationary, or be movable on wheels or otherwise for repairs etc. When removed, the channels communicating with the regenerators may be connected together by a tube ; "thus the gas mixture will be conducted into the "opposite regenerators and there burned" to keep up the heat. There are rings to be fastened over the seams between the said channels and the openings into the furnace, when the latter is brought to its place. Two focus-flames may be employed side by side, and small tubes, used in place of a channel, may be cooled by air or water around them. The dimensions and form of the furnace may vary with the charge, and with the number of flames and manner in which they are introduced from the end, sides, or top of the furnace, any desired direction, form, and extension being given to the focus-flames.

[*Drawing.*]

A.D. 1880, October 19.—No. 4259.

GUTENSOHN, Adolf. -- Recovering tin, while utilizing phosphate of alumina to obtain phosphoric acid.

This phosphate in fragments or powder may be mixed with cuttings or fragments of tin plate, the mixture being pressed into an iron receptacle and heated to redness in a furnace. Thereupon the tin of the tin plate becomes oxidized, and phosphoric acid, set free from the phosphate, combines with the oxide of tin produced, forming phosphate of tin. Next, some more phosphoric acid is set free, more phosphate of tin being

produced but mingled with free phosphoric acid. If the heating be further continued and the temperature be sufficient, metallic iron is obtained, the tin being entirely removed. The phosphate of tin thus produced may be treated by known means to obtain phosphoric acid and metallic tin, and any metallic tin, mixed with the alumina which remains and with the scale which comes off the iron, may be recovered by washing and sifting. Before the treatment described, the tin plate may be dipped in a solution of muriatic acid or muriate of ammonia.

[*No Drawings.*]

A.D. 1880, October 20.—No. 4268.

REES, Thomas Henry. — (*Provisional protection only.*) — Coating metal and other surfaces.

Luminous powder is prepared by calcining pearl shells, magnesia, lime, carbonate of lime, alabaster, or rock crystal, with sulphur or a suitable sulphate. It may be ground up with dry or liquid colours. Paper, textile fabrics, metal, wood, glass, or earthenware is covered or printed with size or varnish, and dusted over with the powder. The material is then dried, rolled, and glazed or varnished.

[*No Drawings.*]

A.D. 1880, October 20.—No. 4276.

BREWER, Edward Griffith. — (*A communication from Thomas Alva Edison.*)—Treatment of auriferous ores; and magnetic separators.

The gold, or greater part thereof, contained in auriferous sulphurets, being stated to exist as free gold, and sulphuret of iron and ferrous oxide to be slightly magnetic, the following process may be employed for removing the ferrous compounds constituting the greater part of the gangue from the auriferous portion of the ore. The ore is simply ground, the iron remaining in the form of sulphuret, unless the gold be in a very fine state, in which case the ore is roasted and ground, the sulphuret being converted into ferrous oxide. The ground material is then submitted to the action of magnets of great strength, due to large currents from powerful magneto or dynamo-electric machines. The material falls past the poles of the magnets, the attraction of which alters the path of the iron

compounds and draws them away from the non-magnetic portion, the magnetic and non-magnetic substances falling into different receptacles. There may be used U-shaped electro-magnets, made up of one or several series of coils. "Where several "series of coils are used, their polar faces or extensions are united "to form one polar face or extension for one polarity, the polar "face being placed at right angles to the flow of the material "to be treated." As the first pole draws the magnetic material out of its course, the second, if placed in the same plane relatively to the path of the material, would act at a shorter distance than the first; hence it should be placed at the rear of the first a distance approximately equal to that which the magnetic material has been drawn out of its path by the first. The operation may be several times repeated to ensure thorough separation. To provide for some portion of the material being more magnetic than another, different sets of magnets may be arranged successively nearer to the path of the falling material; the first set, which is farthest away, acting on the more magnetic portion. Thus, three separators may be arranged in series, "somewhat in echelon, so that the portion "which passes into the non-magnetic receptacle of the first passes "immediately to the second separator, and so on through the "series, the magnetic receptacles of all the series leading to a "common" shoot. There may be a hopper above each separator, a sieve, and an elevator for carrying the sifted material up to the first separator. The separating-machine may be used in other cases.

[*Drawing.*]

A.D. 1880, October 20.—No. 4278.

BULL, HENRY CLAY.—Manufacture of coke.

Washing coal. The coal to be used is fed through a shoot into a tank, filled with water through a spout, and fitted with a revolving shaft, carrying arms by which the coal is kept agitated. From the tank the water and coal pass together to a series of settling-tanks in which are fitted weirs arranged so as to ensure a gradual rise of the water &c. in the tanks and a rapid overflow down the weirs, thus depositing the different densities of coal in the different tanks. The water is finally discharged from the last tank.

[*Drawing.*]

A.D. 1880, October 21.—No. 4285.

THOMAS, Sidney Gilchrist, and GILCHRIST, Percy Carlyle.—Making and repairing basic linings for Bessemer converters and other furnaces. Refactory basic materials for lining furnaces.

Shrunk lime, for lining metallurgical furnaces, may be produced by burning magnesian limestone or magnesian lime in a basic-lined cupola, or ordinary limestone or lime can be used, but should contain more silica and alumina (about 4 or 5 p. c. together) than is requisite with dolomitic lime. Coke is first charged, and afterwards about equal volumes of coke and of dolomite (preferably broken to about the size of a fist). Plenty of hot blast should be admitted by numerous tuyères placed within a few inches from the bottom, which may be a circular flat wrought-iron plate, covered with lime and tar, and fastened to the shell of the cupola by bolts and cottars. Charging is continued, sometimes using less coke, till the lower part of the cupola is full of shrunk dolomite and the charges descend very slowly, an intense white heat being requisite. After all the coke is burnt out, the said bottom may be slid on one side, and a truck to receive the burnt material can be run under the cupola, if supported on pillars. A cupola of larger section below than above is preferred. Instead of a coke or coke and coal cupola, a gas cupola may be employed, gas from a generator being burnt with blast. The blast may be passed through a cupola in which a charge of dolomite has been burnt but has not had time to cool ; or regenerators may be used for heating the blast.

To operate cheaply and quickly in making and repairing basic linings for furnaces without ramming, the inventors prepare a liquid or semi-liquid mixture of hard shrunk magnesian lime and tar (say, 3 parts of good shrunk lime to 1 of boiled tar). The coarsely-ground lime may be mixed with the tar in a mill, which is advantageously steam-jacketed. Modes of lining Bessemer converters and of making converter bottoms are described ; and "furnace hearths and cupola linings may be "made or repaired in an exactly similar manner." A Bessemer converter may be placed vertically with either the throat or the bottom upwards, the then uppermost section being removed for the insertion of a pattern or mould of cast or wrought iron or steel. The mould consists of pieces, which are fastened in

position inside the converter by the aid of cross-bars, etc., so that the exterior of the mould has the shape to be given to the interior of the lining. " A mould in one piece may always be " used if the taper of the lining is considerable." A fire is made inside the mould and a little blast applied to thoroughly heat it. The lime and tar mixture, preferably heated enough to keep it liquid, is poured or thrown between the mould and the shell, so as to fill the intervening space. " The fire is kept up " till the liquid lime mass sets hard," which will take from 2 to 4 hours. In the case of a converter bottom, a lime mixture (less liquid than that used for lining) is thrown into the ordinary circular iron bottom mould, round the tuyères or tuyère pins, and the bottom (with a heavy iron plate thereon) is coked in an oven or stove for several days, preferably at a low red heat. Changeable sections of converters may be likewise lined, or without stove-drying.

[*No Drawings.*]

A.D. 1880, October 21.—No. 4290.

PARSONS, Perceval Moses.—Casting ingots etc. of copper, and bronze and other alloys of copper.

To obtain greater strength and soundness, pressure to be applied to the metal, while fluid or soft, in the moulds, which are made of strong cast iron or other metal. For casting plain ingots, the mould is preferably made cylindrical externally, and slightly conical or tapered internally, with a hole at the bottom, which is closed by a plug, and through which a drift or plunger is afterwards inserted for forcing the ingot out of the mould along with the plug, the conical or taper form facilitating this. The taper may be reduced to nearly nothing in a very short mould with smooth surface. For producing long ingots perfectly cylindrical or parallel, the slightly-conical mould may be provided with well-fitting lining-pieces of the required form which are driven out of the mould with the ingot.

The moulds are placed on a frame or table under an hydraulic or other press, exerting a pressure of several tons on each square inch area of the plunger, which fits the mouth of the mould and is forced in, after the metal has been poured into the mould.

The invention extends to making other castings, including tubular ingots. Casting metals under pressure is not claimed generally.

[*Drawing.*]

A.D. 1880, October 26.—No. 4358.

HEWITT, William.—(*Complete Specification but no Letters Patent.*)—Annealing.

A non-oxidizing medium for charging annealing-pots may be obtained by utilizing hydrogen gas, generated in cleaning iron and steel wire, plates, and kindred articles. According to the description and drawing, hydrogen gas is conveyed from a covered cleaning-tub to a gas reservoir, and thence through a tube provided with a stop-cock into the bottom of the pot used for annealing wire and kindred articles. The annealing-furnace has a longitudinal pier, upon which rests a saucer for the annealing-pot, and at the sides of which are grates for the fires. The brickwork of the furnace encloses an annular conical space, over which is the furnace cover, the latter containing the ordinary exit for the gases of combustion, while there is a side flue for use during charging. A cover, which is hermetically secured on the annealing-pot, has an orifice for the escape of air from the pot, this orifice being closed after the pot has been charged with hydrogen.

[*Drawing.*]

A.D. 1880, October 26.—No. 4359.

HEWITT, William.—(*Complete Specification but no Letters Patent.*)—Gas furnace.

Drawings are given of a reverberatory furnace to be heated by burning the hydrogen gas, which is generated in cleaning iron and steel wire and like processes, and is collected in a reservoir. The combustion chamber, which is separated from the reverberatory chamber of the furnace by a bridge, is filled with loose brickwork, so that the gas, entering by a port at the bottom of the chamber, may ascend through the brickwork. Tuyères in the back wall of the furnace open into the combustion chamber above the loose brickwork, and the air thus

supplied mingles there with the gas, a flame being produced the intensity of which may be regulated by the supply of gas and blast.

For obtaining the gas, apparatus is described consisting of a vessel for containing dilute acid, provided with a cover which is hinged to a standard, and which may be raised by a chain and counterweight. The cover is provided with a flange which extends into the acid, thus rendering it airtight. The wire or plates are placed in the acid, which attacks them and removes the coating of oxide of iron, hydrogen being liberated, which is conveyed to a reservoir or to the gas furnace.

[*Drawing.*]

A.D. 1880, November 2.—No. 4479.

GRIFFITHS, William.—Reverberatory furnaces for puddling, heating, and balling.

" The neck and ordinary flue (and in a puddling furnace the " flue bridge also) are entirely dispensed with ; and the flue is " carried up through the crown of the puddling chamber, or the " heating or balling chamber, at or near the end where the flue " usually occurs ; the said end" being " closed in by plates and " brickwork, with a door" generally arranged therein. This end door is used in place of the ordinary side door in single-handed puddling-furnaces, and in addition to a door at each side in " treble-handed puddling furnaces," the latter doors being also those used for double-handed puddling-furnaces. " For a " treble-handed furnace, the puddling chamber is shaped as for " a double one ; but in addition thereto the chamber is shaped " out towards the end door so as to be suitable for the third hand." In a single furnace, " the puddling chamber stands across the " furnace instead of lengthwise," and its corners at the same side or end as the door may be slanted off by means of furnace plates. The heating and balling furnace resembles the single puddling-furnace, but the crown of the reverberatory chamber is more depressed at the door end to throw the flame on to the iron near the door. The piles, blooms, etc. are charged endways into the furnace so that the flame plays along and between, instead of across, them, and the heating is facilitated. Side doors being dispensed with, currents of cold air and consequent waste of iron and fuel are avoided. The bed slopes towards

one corner of the firebridge, where the cinder is tapped out into a wagon without requiring any special fire. The above-mentioned upward flue may lead into a chimney carried over the furnace on stanchions, or into the internal flue of a boiler above the furnace.

The doors of puddling and heating furnaces (and especially the said end doors) may be constructed with a hollow air-circulating space, formed by a plate which extends the whole width of the door. There are openings for the entrance and exit of air, which is drawn through by the chimney draught. The door is lined with brick as usual.

[*Drawing.*]

A.D. 1880, November 3.—No. 4496.

HUGHES, WALTER WATSON.—(*Letters Patent void for want of final Specification.*) — Extracting metals and sulphur from ores.

A reducing-furnace, preferably considerably longer than it is broad, has in both sides and ends small fireplaces, which are placed a few inches above the bottom of the furnace, and have iron doors or other regulators of the air entering the fire. Such fuel is used as will best conduce, in conjunction with sulphur if present in the ores, to the rapid fusion of the contents of the furnace. The furnace is arched over, and flues carry off the ascending sulphur or gases to collecting-chambers. The materials, including fluxes etc., forming the charge for the furnace, are previously mixed together, the necessary silicious matter being generally present to prevent the iron in the charge from injuring this or other furnace. The molten metal and slag from this furnace will constantly run into a converter furnace above the line of tuyères, which are so placed, whether blowing upwards or downwards, that the blast will carry the metal and slag onwards from tuyère to tuyère, and that the contents of the furnace shall receive a slight circular motion, the furnace being preferably round. "The metal or metals "and slag after the former has been oxidised may be run off "at different levels," or the light slag may be run off at the top and the heavier contents rise up thereto through a space in the wall, "so that they will run into the separating or refining "furnace together; or the metal may be tapped off from the

"bottom of the furnace." The converter furnace may be worked by hot or cold blast on the Bessemer principle. Cold air, when required to cool the contents, may be admitted through side openings. There is a communication with collecting-chambers. In the separating or refining furnace, "if "the heavy slag is not wanted to be kept by itself for the iron "it contains, it and the light slag will be run or drawn off "together; and only the copper and other heavy metals left in "the lower part of the furnace, and which may now be refined "and run out." This is a reverberatory furnace with sides sloping towards the centre of the bottom. A channel runs lengthwise in the bottom with a small basin at one end, from which any accumulated heavy metal may be ladled out for treatment "in a small furnace or large pot in the usual way "for any of the richer metals."

[*No Drawings.*]

A.D. 1880, November 4.—No. 4510.

STRATTON, David.—(*A communication from Arthur Hope.*) —Stone-breaking machines.

In machines with a fixed and a vibrating jaw, the latter being actuated through a rotating crank which gives a vertical reciprocating movement to a connecting-bar forming the middle piece of a horizontal toggle combination between the vibrating jaw and an adjustable stationary bolster; the toggle pieces or struts, placed between the middle piece and the jaw and bolster, respectively, are to be shaped so as to produce two or three times as many strokes as usual. Instead of having a single bearing or acting surface at each end, each toggle piece employed has a single bearing part at one end and two or three at the other. The bearing parts may be convex and fit in concavities formed on the jaw, middle piece, and bolster; or *vice versâ*. The effect is as though the middle piece were acting on two or three pairs of toggle pieces in succession, the number of bites being thus doubled or trebled. A movable wedge, between the middle piece and the crank bearing, allows of the best adjustment. The toggle pieces are shown in drawings as having the single bearing part at the end next to the middle piece.

[*Drawing.*]

A.D. 1880, November 9.—No. 4582.

JONES, John. — (*Provisional protection only.*) — Puddling furnace.

A furnace for three puddlers to work at, so as to effect savings and increase the product, is preferably oblong in shape with two of the corners cut off, to aid the working and prevent metal, when soft, from becoming wedged in the corners. The stack or flue is built upon the top of the furnace to make room for the third puddler, there being a door "in the front end of the "furnace" and in each side.

[*No Drawings.*]

A.D. 1880, November 11.—No. 4632.

WILLIAMSON, William Shepherd.—Puddling-furnaces.

Into the space below the hearth, which is shut off from that below the grate, air may be injected by means of a steam blast. The first-mentioned space is enclosed by walls, access thereto being provided by a door. In the bottom of the hearth or in the walls of the furnace are formed holes and passages, leading upward to exit flues. The injected air, issuing upwards, comes into contact with the under side of the plates of the hearth bottom and with the jamb plates (including the bridge plates and wall plates), and passes in different directions to the exit flues, its flow therethrough being controlled by dampers or plates. To supply the air, a jet of steam may descend into a vertical pipe, which is connected by a bend to another pipe, having an upward curving bell-mouthed delivery for directing the air upwards towards the bottom plates. Thus the heating of the said plates is checked and greater durability obtained, the cooling effect being regulated by the intensity of the steam blast. The mode of employing the air may be modified.

Air may be likewise introduced into the enclosed space below the grate to supply the fire, the working of the furnace being better controlled.

[*Drawing.*]

A.D. 1880, November 11.—No. 4637.

JORDAN, Thomas Rowland. — Pulverizing-machines with appliances for delivering and separating the products.

Referring to the prior Specification, No. 4951, A.D. 1879, the inventor is now careful to form the outside faces of the fans or beaters and the inside faces and periphery of the crushing-chamber so as to ensure an approximately close fit without contact, turning them true if needful. Through the outside castings and as close as possible to the shaft bearings, there are provided apertures (adjustable in size by sliding doors) for a draught of air. The latter is induced by curved or angular vanes or fans (preferably cast in a recess on the outside of the beater castings or on their interior face) to pass into the crushing-chamber, whence it is ejected by the revolving beaters into delivery pipes. These pipes, one on each side of the chamber, issue at a point preferably above the centre of rotation, and are set vertically or obliquely upwards to an adjustable height. This is effected by telescopic joints ; or by means of an interior outlet pipe, working in an exterior casing, and pierced with apertures at different levels and in different angular positions around it, so that any aperture of required height may be put into communication with a delivery shoot by rotating the interior pipe through the requisite angle. The force of blast (regulated by the adjustable inlet apertures and the speed of revolution) and the height of the delivery determine the weight or fineness of the particles ejected by the blast, insufficiently-pulverized particles remaining in or returning by gravitation to the crushing-chamber until reduced so fine that they can become suspended by the current of air. Thus, the crushed material is delivered and separated to any degree of fineness without using sieves.

[*Drawing.*]

A.D. 1880, November 13.—No. 4681.

SMITH, Napier. — (*Provisional protection only.*) — Coating metals.

Relates to a method of preparing pipes, sheets, and other articles of iron to receive a protective coating by Dr. Angus Smith's or similar process.

The pipe or other article, by preference in a heated condition, is dipped into lime water or other convenient alkaline liquid It dries by its own heat, and is ready to receive the bituminous or similar coating.

In the case of castings a similar result may be obtained by using milk of lime in place of the moulder's blackening for coating the moulds and cores.

Iron or steel plates for roofing, shipbuilding, etc. may be advantageously treated.

[*No Drawings.*]

A.D. 1880, November 15.—No. 4698.

SHACKLETON, Edward Jowett, and KEMP, George James.—(*Provisional protection only.*)—Grinding, crushing, and pulverizing, especially brick earth, chalk, flints, and ores.

There is a large revolving pan with a smaller pan in centre. The former contains preferably four cast-iron or other rollers, which revolve on their axes by the motion of the pan and run in different tracks, so that the substance treated is crushed four times before reaching the circumference. The smaller pan also has a roller, and the substance there crushed is forced out and on to the large pan. Again, the pan may be stationary and the rollers be driven.

[*No Drawings.*]

A.D. 1880, November 17.—No. 4745.

GORDON, James Edward Henry.—(*Provisional protection only.*)—Incandescent electric lamps.

When iridium or other precious metal is employed as the source of light, a loss of metal is experienced after a time. To recover the dissipated metal, a current of air is made to pass through the lamp, and afterwards through a flue in which a large surface of an inert substance, such as glass wool, is exposed. The metal, in a finely-divided state, deposits itself on the surface over which the air passes, and after a time the surface becomes blackened. The deposit is collected from the inert substance, and reworked by ordinary refinery processes.

[*No Drawings.*]

A.D. 1880, November 18.—No. 4760.

COOKSON, Norman Charles, and SANDERSON, Thomas Crisp.—(*Provisional protection only.*)—Treating mixed ores.

Ores, containing lead with zinc and, it may be, silver and copper, are thoroughly roasted ; and then the zinc and copper, if any, are dissolved out by acetic acid. The copper is afterwards precipitated by adding metallic zinc to the solution, and the zinc by hydrogen sulphide. The lead and silver can be separated from the gangue by usual means.

From raw ores, containing lead with antimony and, it may be, silver, the antimony sulphide is dissolved out by sodium or other alkaline sulphide solution, from which it is precipitated by sulphuric or other acid.

Again, the zinc may be dissolved out by sulphuric acid from thoroughly-roasted ores containing lead with zinc, and to the zinc-sulphate solution some of the above-mentioned antimony sulphide solution is added. Zinc and antimony sulphides precipitate and can be separated from one another in various ways, the zinc being preferably dissolved by weak hydrochloric acid and afterwards precipitated by milk of lime.

[*No Drawings.*]

A.D. 1880, November 20.—No. 4798.

HILL, Robert Ashmore, and BARLOW, Henry Bernoulli. —Cleaning and annealing wire etc.

To cleanse and anneal wire and metal strips before shaping them by rolling, they are drawn through a bath of molten lead.

[*Drawing.*]

A.D. 1880, November 20.—No. 4821.

LAKE, William Robert.—(*A communication from Joseph Célestin Bourdenet, and Adolphe Pradou.*)—Preventing oxidation of metal surfaces.

Lead, preferably granulated or in filings, is added to olive oil in a non-metallic vessel. After standing for some time the turbid liquid is decanted and allowed to stand till clear, when the clear liquid is poured off. Metals of all kinds can be coated with this liquid, either in a bath, or by means of a brush or otherwise. When dry a fatty coating is formed on the metal which protects it from oxidation and from injury by moisture.

[*No Drawings.*]

A.D. 1880, November 22.—No. 4837.

HUTCHINGS, Richard James, TAYLOR, Henry Francis, and STRUNÉ, William Peddie.—Pickling and swilling metal plates &c.

The invention consists of improvements in the apparatus described in Specifications No. 1171, A.D. 1876, No. 1785, A.D. 1878, and No. 1929, A.D. 1880.

The plates or other objects are placed in a cradle mounted on wheels running on rails placed inside or outside the baths containing the acid and water. The baths in one form of the apparatus are slanting, and at the top is a turntable for shunting the cradles to one bath or the other, or to the loading and delivery side. Each cradle has a chain, connected to a lever operated by a steam cylinder carried on the turntable by which the cradles are oscillated whilst in the baths. Chains are attached also to the cradles and wound on drums geared together and worked by a windlass to raise or lower the cradles out of or into the baths. The baths may be heated or not as desired. The surface of the turntable is slanting and has grooves to convey the drippings from the cradles to the respective baths, care being taken to prevent the acid flowing into the water bath. The turntable is carried from a bed-plate by a central pivot, and friction-wheels near the periphery.

In another arrangement the chains for oscillating the cradles are attached to a sector placed beneath the turntable and oscillated by a rod and crank from a shaft driven by a pulley and belt. The oscillating chains are arranged so that they are automatically attached to and detached from the cradles as they enter and leave the baths.

In another form of apparatus the cradle is supported in the bath on a frame, mounted on wheels running on curved rails, and is oscillated by a rod and crank shaft. The cradles are hung from arms, fixed to the piston of a steam or other cylinder, by which the cradles are raised out of or lowered into the baths. The arms may also be moved round to deposit the cradles in either bath as required. The weight of the cradles &c. may be balanced by counterweights. The rails may be curved laterally or vertically or corrugated to give the cradle a vibratory movement in addition to the to and fro movement. The rails or wheels or both may be formed with projections or the rails

may be flat and have teeth on them which engage with teeth on the wheels which are mounted eccentrically on their axles to obtain the vibratory movement.

In another form the cradle is suspended by chains or bearings from a carrier, supported upon standards, which have a central foot, and forked extensions resting in shoes. The standards are rocked by a rod from a crank so that the cradle receives a compound motion. The foot may be omitted so that a jerk is given to the cradle at the middle of the stroke.

In another arrangement, the cradle is suspended from a horizontal rod carried at each end by a crank, so that as the cranks rotate the cradle receives a circular motion. The cradle may remain stationary whilst the bath receives the motion.

In another construction of apparatus the cradles are suspended in the baths by chains from a triangle which is carried by the piston-rod of a cylinder. A neck depends from the triangle and carries rollers, running on cam tracks formed on the top of the central well, which extends through the bath. Clutches on the necks engage with shafts, which are rocked from a crank driven from a belt pulley or otherwise, so that the cradles receive a screw-like motion in the baths. A spring coupling is used to prevent concussion at the end of the stroke. The baths may have ribs on their inner surfaces which further agitate the liquids as the cradles are oscillated.

In another arrangement similar to the above the baths are carried upon the pistons of steam or other cylinders, so that they may be raised to or lowered from the cradles. Fixed screws pass vertically through the cradles, so that as they are moved up and down the screws impart to them a circular motion in a horizontal plane.

Various other mechanical arrangements are illustrated and described for giving motion to the cradles.

[*Drawings.*]

A.D. 1880, November 22.—No. 4844.

LAKE, William Robert.—(*A communication from Alfred Braconnier.*) — Treating dolomite for the manufacture of refractory material.

Dolomitic refractory materials are stated to be durable in proportion to the quantity of magnesia they contain. Calcined dolomites are treated with a solution of hydrochlorate of ammonia to extract lime, while the magnesia and foreign matters present remain insoluble, the calcined dolomite being thus enriched in magnesia to any desired extent. The hydrochlorate may be specially made, or be the purified product of some manufacturing process. To hydrochlorate of ammonia liquor (from the manufacture of soda) there may be first added just sufficient slaked lime to saturate the free carbonic acid and reduce the bicarbonate of soda present to a simple carbonate, and afterwards sufficient solution of chloride of calcium (produced in previous operations) to transform the carbonate of soda into chloride of sodium. After settling, decanting, and filtering, the liquor is "treated with a suitable proportion of "calcined dolomite." Ammonia becomes liberated and is collected, and the dissolved lime will be in the form of chloride of calcium. Into the chloride of calcium solution there is introduced carbonic acid with the liberated ammonia; thus hydrochlorate of ammonia is again formed, while carbonate of lime is precipitated and separated.

Likewise by this process pure magnesia may be prepared, "if only the dolomite itself be pure."

[*No Drawings.*]

A.D. 1880, November 24.—No. 4882.

KNOWLES, Sir Francis Charles.—Reducing mineral or other stones to fragments.

Stony minerals, ores, etc., when reduced to about the size used in lime burning, are heated in a furnace or kiln to cherry redness. They are drawn while heated, and plunged into cold water or quenched with water. The resulting fragments, when cold, are crushed by rollers or otherwise.

If the mineral gangue be carbonate of lime, the operation is aided by the accompanying chemical slaking. The claim is for cracking and breaking up minerals, etc., by heating and applying water as described.

[*No Drawings.*]

A.D. 1880, November 26.—No. 4932.

LYTE, FARNHAM MAXWELL.—Treatment of ores and metallic mixtures of lead and zinc with or without silver or copper.

Referring to his prior Specifications, Nos. 633 and 2807, A.D. 1877, No. 269, A.D. 1879, and No. 1051, A.D. 1880, the inventor sometimes economically uses (instead of hot) cold or slightly warm (preferably hydrochloric) acid in treating the ore, calcined as sweet as possible but not at too high a temperature. After some time the cold treatment may be sometimes assisted by heat. According to circumstances, the zinc and all or part of the copper are dissolved. After settling, the liquor may be decanted on to a batch of fresh ore and becomes more or less neutralized, most of the lead and silver taken up being reprecipitated. The liquor is afterwards drawn off clear ; or it may be filtered, some of the ground ore itself, placed in a vessel with a false bottom, being suitable as a filter. From the liquor the copper and any silver may be thrown down by metallic iron, or the traces of lead, copper, and silver, by spelter or by hydric sulphide or a soluble sulphide. In recovering the zinc oxide from the solution, hot or boiling, by precipitation with milk of lime, the least excess of the latter should be used rather than that there should be undecomposed zinc chloride.

The gangue, containing lead and silver but exhausted of zinc, may be smelted with fluxes to obtain the lead and silver together. Interference from the volatility of the chlorides of these metals may be checked by first washing out the acid zinc chloride and then smelting with scrap iron ; or by treating with an alkaline or alkalino-earthy sulphide (say, tank waste of alkali works) to convert the chlorides into sulphides, the resulting alkaline or alkalino-earthy chloride and any other soluble chlorides being washed out previously to smelting ; or by reducing the lead and silver chlorides by spelter, the zinc chloride formed being washed out before smelting. Some pure galena or metallic lead may be added to the charge to collect the rest of the lead and silver, which otherwise might not readily run together.

Again, the gangue may be treated in the wet way with brine or a solution of an alkalino-earthy chloride to obtain the lead and silver.

For the cold acid treatment above referred to, the attacking-tubs need not be raised by a ram or lift for decanting the liquors

from one tub to another. In this case a pump, injector, siphon, or other apparatus is suitable, instead of changing the respective levels of the tubs. Thus, a portable ebonite pump or a portable injector (blow jack) furnished with a suction pipe of embedded rubber suction hose and a rubber delivery hose may be used.

Sometimes, to extract the silver, the argentiferous brine or other chloride solution may be run over or through spongy or finely-divided lead, or be otherwise brought into intimate or prolonged contact with extended and clean lead surfaces. By using heat the surfaces are kept cleaner, the heated solution being able to dissolve the lead chloride, which is formed by the reduction of the silver chloride or other reducible chlorides present.

[*No Drawings.*]

A.D. 1880, November 27.—No. 4952.

CLARK, ALEXANDER MELVILLE.—(*A communication from Jules Garnier.*)—(*Provisional protection only.*)—Manufacture of copper.

1. To check deterioration of the furnace from the silicious lining being attacked when oxidizable metals are eliminated as oxides; the reverberatory or other furnaces for refining and toughening copper may be lined with basic material, like lime, magnesia, calcined dolomite, or bauxite, made into bricks or merely laid on with or without binding-materials. Then the impurities, like bismuth, lead, manganese, iron, sulphur, arsenic, antimony, and phosphorus, are more quickly eliminated from the copper by contact with the oxides etc. forming the bed and without causing deterioration.

2. The electrical conductivity of copper may be improved or reduced as required. Copper, containing a little oxygen, is a poor conductor of electricity. By adding to the copper in the furnace, just before tapping, sufficient of a phosphorus compound, like phosphide of copper, to eliminate the oxygen its conductivity is improved.

If the conductivity of copper sheathing, which is quickly destroyed by galvanic action, be lessened, it will last longer. Copper by containing phosphorus is rendered a poor conductor, the proportion of phosphorus being such as not to affect the malleability of the copper.

[*No Drawings.*]

A.D. 1880, November 29.—No. 4968.

MACAY, JUAN FRANCISCO NEPOMUCENO.—Dissolving and filtering apparatus for chemical and metallurgical processes.

The inventor refers to his subsequent Specification No. 2359, A.D. 1881.

According to the present invention, which is applicable to the treatment of pulverized ores by solvents, an outer wooden or other cylinder or shell concentrically encloses an inner hard, wooden, earthenware, stoneware, or other cylinder, perforated with numerous holes, and lined with asbestos cloth or other filtering-material. The inner cylinder is kept in place by longitudinal and circumferential partitions, the former of which divide the annular space between the two cylinders into several compartments respectively provided with draw-off cocks for running off filtered liquid. The apparatus is carried upon grooved rollers mounted in a frame or cradle, and can be revolved by hand or power. The outer cylinder, when of wood, is preferably barrel-shaped, and is built up of staves jointed together and bound by iron hoops. The heads are so secured by hoops, tie-rods etc. as to be removable, an india-rubber ring forming a water-tight joint between each head and the body of the barrel. One head contains (preferably four) manholes, closed by flanged covers with water-tight washers, cross bars bearing centrally on the covers. The centre of this head has an aperture, which may be used for charging and as a sight hole, and which is closed when working under pressure or left open for the escape of air, gases, or liquid blown in (as mentioned below). The other head possesses radial passages, leading to the different compartments of the annular space from a central distributing-valve, which consists of an outer shell, an intermediate conical sleeve, and an inner tubular plug attached to a supply pipe, a central bolt tieing the whole together. The conical sleeve has one or more ports, and is adjusted in any desired position by a wheel and screw. The outer shell revolves upon this sleeve with the barrel, and thus the radial passages are brought in succession into communication with the supply pipe at any desired points of the revolution, so that fluid may be forced into or withdrawn from any compartment of the annular space at will, and consequently to or from the inner cylinder through the filtering-surface and through the contents of the barrel or not as required. The

inner cylinder, which contains the matters for treatment and solvents, preferably has the form of a polygonal prism, and may be constructed of staves jointed together and supported by wooden rings, a strengthening-lining being fixed to the inside of the heads. The asbestos cloth may be caulked into grooves with asbestos yarn or cloth cuttings. Dashboards, preferably inclined or tangential, can be arranged round the interior of the inner cylinder. The rotary motion of the apparatus causes intimate contact of the solid matters with the solvents, and, by forcing steam or air into the annular space and thence through the filtering-medium into the inner cylinder, the filtering-surface is cleared of adhering solid matters and the latter are kept in suspension in the liquid. Also the liquid, passing into the longitudinal compartments of the annular space, is carried round by the rotation and, flowing back into the inner cylinder, helps to keep the filtering-surface clear. The solid and liquid matters carried round by the dashboards should fall from one to another without injuring the filtering-cloth, thorough agitation and intimate mixture being obtained. To separate the solution produced from the undissolved residue, the said cocks are opened, and by a slow rotation of the apparatus the liquid may be decanted off from the bulk of the residue and at the same time be filtered from any suspended matters. Materials, acted on by the matters treated or the solvents, should be avoided in constructing the parts of the apparatus where there would be contact.

[*Drawings.*]

A.D. 1880, December 3.—No. 5037.

PARNELL, Edward Andrew, and FRENCH, Andrew.—(*Provisional protection only.*)—Treating cupreous ores containing zinc, and smelting-furnaces therefor and for like purposes.

Reference is made to the prior Specifications No. 820, A.D. 1877, and No. 5239, A.D. 1878.

To recover the zinc, ores, containing copper and zinc wholly or partly as sulphides, may be smelted in a cupola furnace, and the gases and fumes therefrom, containing metallic zinc and oxide of zinc in suspension and sulphurous acid, are mixed with

excess of air and brought into contact with water in a condensing or absorbing apparatus, preferably such as that to which the secondly-mentioned prior Specification relates. The oxide of zinc then combines with sulphurous acid to form sulphite, which is converted into sulphate by the excess of oxygen, and by lixiviation the sulphate is separated from any uncombined oxide of zinc. The liquor may be now evaporated to obtain crystallized sulphate, or be otherwise used, as for producing oxide of zinc and sulphuric acid in accordance with the first-mentioned prior Specification.

The little lead sometimes present is almost wholly volatilized with the zinc, and the fume can be treated with dilute sulphuric acid to dissolve out zinc oxide and leave lead sulphate undissolved. Silver, if present, is partly volatilized and is recovered with the lead.

Inside the hot-blast cupola employed, above the charge and round the sides, are placed a set of about 7-inch cast-iron pipes, which, where exposed to the fire, are preferably oval (9 inches vertically and 3½ horizontally) in section. They form one continuous pipe, the upper or inlet end being connected to the fan or blower, and the lower end to the tuyères. For the ores described, the bottom of the charging-door should not be more than 2½ feet above the tuyères to avoid inconvenient accretions on the walls. Smelting is conducted as in treating copper ores in a blast furnace to obtain regulus. The copper and most of the silver and gold present are found in the regulus, which is tapped off at intervals. The copper is better freed than heretofore from injurious metals, like zinc, arsenic, and antimony.

[*No Drawings.*]

A.D. 1880, December 7.—No. 5104.

LAKE, William Robert.—(*A communication from Frederic Augustus Luckenbach, John Wolfenden, and Lyman Franklin Holman.*)—Pulverizing minerals etc.

Ores and other substances may be pulverized by bringing into forcible contact opposing currents of steam, air, or other gaseous fluid, carrying the substances for treatment (which are preferably of about pea size); thus two charged currents may be directed on the same line in opposite directions, or several

opposing currents on parallel lines in the same or in different planes ; but preferably several currents are directed to a common centre or focal point. The apparatus comprises an annular chamber, whence the gaseous fluid under a pressure of, say, 150 lbs. to the square inch travels through passages or valves into inner tubes converging towards the central point. Thus there is created in outer tubes (shown in a drawing as forming extensions of the inner tubes, but with an intermediate space left between their suitably shaped adjacent ends to form the said gas passages) a sufficient vacuum to draw the substances for treatment from attached hoppers into the tubes, whence they are carried by the currents to the central point and crushed or pulverized by the collision of the opposing charged currents. The inner and outer tubes, which are made adjustable to regulate the size of the gas passages between them and also the distance of the inner ends of the inner tubes from one another, form straight inlet passages for the substances and preferably have readily removable hardened metal or glass linings ; while the inner ends of the inner tubes are preferably protected by movable soft metal caps, variable in shape and size. A circular chamber, shown in a drawing as arranged to catch the pulverized substances, has a closely fitting cover ; while a subjacent discharge hopper may lead by a pipe to a receptacle. The apparatus preferably has tubular iron supports.

[*Drawing.*]

A.D. 1880, December 10.—No. 5169.

LOVERING, John, junior.—Washing clay.

The stream of water and clay is passed as usual along channels in which it deposits its heavier particles ; it is then conducted by a channel into a washing-cylinder. This cylinder consists of a framework, mounted on an axis by which it can be rotated. It is lined for a short distance from one end with sheets of zinc, and the remainder with gauze preferably of fine brass wire. As the stream passes through the rotating cylinder, the water with the finely-divided clay in suspension passes through the "gauze" and flows to settling-pits, the foreign matter in suspension passing from the end of the cylinder. The

gauze surfaces are made self-cleaning by causing a stream of water to flow over the edge of a trough on to the top of the cylinder, or by forcing a current of air against the gauze.

[*Drawing.*]

A.D. 1880, December 11.—No. 5194.

WARREN, David, and WARREN, James.—Furnaces.

The invention, which relates to promoting complete combustion and directing a very hot flame upon the material under treatment, is applicable to reverberatory and ore-calcining furnaces, air to combine with the flame being heated as subsequently described and then forced in from above or from the sides, while the hearth and other parts, such as calcining-chambers, are arranged as usual in each case.

A steel-melting furnace, which is described as an example of the invention with reference to drawings, has a firegrate at each end for the slow combustion of fuel. At each corner there is a heating or calcining chamber, through which the hot gases of the furnace are passed to act on the pig iron or other raw material to be afterwards melted. Thence the gases on their way to chimneys are led through series of flues, located above similar air flues, which are themselves built over the crown of the furnace. Air, forced into the air flues, becomes heated by the crown and by the escaping hot gases, and the flames and gases from the firegrates, after passing over the bridges, are met by the heated air, which is directed through openings in the crown or arch of the furnace. Thus an intense heat is created directly over the surface of the materials on the hearth, and the heat is effectively utilized. Also the crown is kept cooler, and the flames issuing from the firegrates are of lower temperature than usual. The furnace is shown as having three doors in each side.

[*Drawings.*]

A.D. 1880, December 13.—No. 5218.

HÖPER, Georg.—Alloys.

Alloys may be produced possessing greater elasticity than phosphor bronze as heretofore made and of equal hardness. Density and resistance to oxidation and friction, in conjunction

with numerous shades of hardness and toughness, may be obtained by combining from 3·5 to 8 p. c. of phosphorus and from 0·5 to 15 p. c. of tin with sufficient copper to make up 100 parts in each case. To obtain great hardness, without seeking much elasticity, from 5 to 8 of phosphorus and 9 to 15 of tin are recommended. These alloys are so hard as to be difficultly worked by tools. To obtain much elasticity with great hardness, from 3·5 to 5 of phosphorus and 5 to 9 of tin may be used. These alloys are workable and, when containing the smaller specified amounts of phosphorus and tin, are rather softer than gun metal. To produce soft alloys possessing great tensile strength and toughness, 3·5 of phosphorus and from 0·5 to 5 of tin are valuable proportions.

As regards alloys chiefly to resist friction; from 4 to 5 of phosphorus and from 7 to 9 of tin are suitable in the case of friction with smooth motion or upon very hard surfaces: from 3·5 to 4 of phosphorus and 5 to 7 of tin may be suited for friction with irregular or jerky motion, more elasticity being here required, and sometimes lead may be added in the proportion of from 2 to 5 p. c. of the total weight: from 3·5 to 4 of phosphorus, 9 to 13 of lead, 2 to 3 of tin, and 3 to 5 of zinc (with copper to make up 100 parts as in each case) may be used for friction with fast motions or upon soft surfaces. In the last case the zinc is added to improve the fusion of the high proportion of lead with the other substances. The proportions of phosphorus specified should be present in the finished alloys. Numerous articles to be made of the different alloys are mentioned.

The invention also relates to moulds for casting.

[*Drawing.*]

A.D. 1880, December 16.—No. 5275.

FITZ-GERALD, Desmond Gerald.—(*Provisional protection only.*)—Crucible.

The invention primarily relates to electric lighting, but the electrical crucible hereinafter referred to is applicable to other purposes.

When the light is obtained by the incandescence of a metallic conductor traversed by the electric current, the inventor embeds the conductor in an infusible substance, like magnesia

or oxide of cadmium, so as to allow of the metal being raised to the temperature at which it softens or fuses. Or he brings the two extremities of the conductor into contact with two conducting masses, separated or insulated from each other by an infusible earth or oxide, the conductor being preferably placed in a groove or recess extending from one to the other of the conducting masses across the fusible partition, this apparatus constituting a kind of electrical crucible.

[*No Drawings.*]

A.D. 1880, December 18.—No. 5313.

DICK, George Alexander.—(*Partly a communication from Charles James Adolph Dick.*)—Alloys.

Reference is made to the prior Specification No. 2306, A.D. 1880.

Alloys, consisting of iron or steel, copper, tin, and phosphorus, with or without lead, and specially applicable for castings, may be made by first melting the copper and tin, which are used pure (when the iron contains sufficient phosphorus) or combined with phosphorus (when the iron does not). The product is cast into ingots, which are added to the iron, heated to bright redness or actually melted in a furnace or crucible. After the desired combinations have produced a uniform liquid, the alloy is stirred and run into ingots or moulds. Lead, when used, is introduced with the copper and tin. The alloys may be remelted at a comparatively low heat without material change of the component proportions. They wear well and are cheap, and may be used for frictional parts of machinery like bearings. The quantity of either copper or tin must not exceed about 12 or 15 p. c. of the perfected alloy, and lead, if used, should not exceed 10 per cent. thereof nor exceed the amount of tin. The phosphorus must increase with the quantity of copper and tin, and *vice versâ*, but must not exceed 2 p. c. The purer the iron (wrought iron, mild or ingot steel, or iron sponge being employed), the more ductile will be the alloy ; comparatively much tin, copper, and lead generally produce the best wearing alloy. To increase the soundness of the castings obtained, a little carbon or "silica" or both (not exceeding altogether about 0·6 per cent. of the iron used) will be sometimes advantageous ; and may be present in the iron used, or added in

combination with iron during the smelting process. A little manganese is not injurious, especially if silica is present. Further information as to proportions of ingredients is given.

[*No Drawings*]

A.D. 1880, December 21.—No. 5355.

WEDEKIND, HERMANN.—(*A communication from Henry Bollinger.*)—(*Letters Patent void for want of final Specification.*) —Refractory materials.

Linings of converters etc. may be moulded or formed of certain materials, similar in their chemical constituents, and known as asbestos, chrysotile, and serpentine, to which may be added binding-materials affording plasticity, such as alumina or kaolin, or "an aqueous solution of hydrogen silicate in the "gelatinised jelly like form." The refractory power may be varied with the proportion of asbestos or chrysotile to that of serpentine. After moulding and drying, "the composition is "soaked or impregnated in vacuo or under pressure with "chloride of magnesium" or analogous alkaline chloride ; it is then dried and burnt. When it contains a silicate in a fluid state, a neutral compound may be obtained or, by continuing the addition of chloride of magnesium, a basic compound. The moulds employed may be coated with a solution of chloride of magnesium.

[*No Drawings.*]

A.D. 1880, December 21.—No. 5365.

CLARK, ALEXANDER MELVILLE.—(*A communication from Jean Baptiste Marie Prosper Closson.*) — Refractory basic materials.

In manufacturing basic firebricks, hollow bricks, crucibles, tuyères, pipes, or other refractory products of magnesia or calcined dolomite or lime, there may be used an animal or vegetable gelatinous substance, such as glue, gelatine, vegetable gelatine, Japanese cement, fucus, and their congeners, and sometimes sugar and molasses, as a binding-material. The patentee takes (1) old magnesia bricks, broken and partly ground to powder, the proportion varying from, say, one-third to two thirds ; (2) magnesia in powder. He moistens with a solution of gelatine or other substance above specified, from 1 to 3 p. c.

or sometimes more of gelatine being used. A paste is formed sufficiently plastic to be moulded into bricks etc. without requiring a press. The moulded articles, after firing at a very high temperature, are very hard and somewhat "translucid like "porcelain." Charcoal may be added to the paste to produce porosity. A slip may be likewise made, "whereby articles "moulded in several pieces may be united perfectly." Sometimes the bricks or pieces may be dipped in a dilute "solution "of the material above mentioned," and the surfaces to be joined be sprinkled with a little powdered magnesia. The method of manufacture applies in the case of dolomite and of lime. "Excellent results may be obtained by calcining the "magnesia at the highest temperature attainable, then adding "to calcined dolomite reduced to coarse powder or lumps a "paste composed of powdered magnesia (overburnt or not) "and glue dissolved in water." Sometimes the proportion of glue is very small. When sufficient pressure is employed, scarcely any water is used.

[*No Drawings.*]

A.D. 1880, December 22.—No. 5366.

ANDERSON, William Francis, and MANT, George.—Breaking-machine.

The invention, which relates to coke-breaking or splitting machines applicable also to various materials, includes a machine with fixed and movable jaws which consist of series of bars o steel or hard metal, arranged to be open at the top and closing upon each other at the bottom. The bars on one side may be actuated by a crank, eccentric, or other means of producing reciprocal motion, and operate on the material under treatment by forcing it through those on the opposite side. Combs may be used for clearing the machine from sticking pieces of material, and may receive a small vertical motion through cranks, a lever, and an eccentric on a shaft. The teeth of the combs come between all the bars, the number of which, arranged in a series within the frame, may vary with the size of the machine.

The jaws of other machines may be furnished with spikes chisel points, or cutting-knives.

[*Drawing.*]

A.D. 1880, December 22.—No. 5385.

LAKE, William Robert.—(*A communication from Ozias Bailey.*)—(*Provisional protection only.*)—Extracting gold from auriferous deposits.

A tank of water contains an iron or other long box, placed at an angle of about 15° to the horizontal, and having a curved bottom composed of grating covered with screen wire. This screen has sections of different degrees of fineness, the finest being at the bottom of the screen where the earth is thrown in and the coarsest at the upper end. An axle or shaft, having its bearings in the ends of the box and arranged parallel to its bottom, projects through the lower end of the box and carries a sprocket-wheel for rotating it. From end to end the shaft carries a row of stirrers or blades set in the form of a screw to convey the tailings or refuse to the upper end of the box to be discharged, the finer earth and precious metals falling through the screen to the bottom of the tank. These grinders or stirrers are so bevelled that they may aid the screw to carry the dirt up and to better mix and grind it: the shaft supports straight grinders in positions not interfering with the screw grinder. A screw conveyer in the bottom of the tank conveys the auriferous earth in the state of slush into the well of an elevator, which by the aid of a chute conducts the slush into an upright or vertical tank, having on its opposite sides a set of inclined amalgam plates to form a zigzag passage down the tank to a well beneath, where pockets of mercury are provided to arrest any coarse or shot gold that may pass down the amalgamated plates. A valve or stop-cock at the lower end of this tank regulates the quantity of slush within it, while controlling the outflow from it into a horizontal tank, the passage-way through which is V-shaped in cross section and zigzag, and may be covered with amalgamated plates, while the bottom of the tank has pockets of quicksilver to arrest any passing gold. Again, the vertical and horizontal tanks may be used separately. To facilitate the operation, a constant current of air, maintained by a double-acting bellows or other blower, is conveyed through main and distributing pipes and is discharged through a rose into the vertical tank near its bottom and in jets into the horizontal tank, forcing the slush towards the discharge end of this tank. The agitation produced in each case aids the securing of the gold by the amalgamated plates. The residual slush passes

into a well, whence the sediment is raised on to an endless apron by an elevator having buckets with wire-gauze bottoms, through which the water trickles back into the well for use again, if scarce, while the sediment is conveyed to a dumping-place. Motion may be imparted to the machine from a line shaft by endless chains in connection with sprocket-wheels, keyed on this shaft and on the journals of the working parts.

[*No Drawings.*]

A.D. 1880, December 22.—No. 5390.

PAULSON, Richard.—Metallurgical furnaces.

Furnace bars are formed with "a deep web or flange "extending along the exposed or under side," to rapidly radiate heat and prevent the bars from being burnt. Perforations extend through them from end to end; or they may be cast in pieces with a groove to admit a tube, so as to produce a hollow bar. The bars not only extend "from the front of the furnace "to the back, but are prolonged and carried upwards at right "angles so as to rest against the bridge." Air is continuously heated in traversing these bars, and on entering the fire "is "brought in contact and combines with the unconsumed gases "and hydrocarbons given off during combustion, thereby causing 'them to ignite and be consumed," greater heat being generated. "One or more solid or perforated bridges of "firebrick or metal" may be so arranged as "to check, baffle, "and mingle the unconsumed gases with the heated air." The invention is further described with reference to boiler furnaces etc.

For smelting and otherwise working copper and other metals, exhaust steam may be used or discharged beneath the furnace "so that the air circulating through and between the bars carries "it with it into the furnace." To make the fire burn more fiercely and produce great heat, the air (sometimes previously heated) may be forced by a fan, injector, etc. to travel more rapidly through the fire and perforated bars, and "the outlet "or opening at the back of the furnace" be contracted, "adding "an expansion chamber when required: the flame may thus be "made to travel a long distance to impinge upon any given "point or substance," and utilized in treating ores, metals, or alloys. "The ends of these bars may be cast separately from

" the bar itself and afterwards screwed or fitted to them." A second casing placed over their exposed ends may protect them from being burnt, and a space be left for admitting air into the furnace, or they may be carried through the firebrick bridge and be curved upwards at its back. A chemical compound, rich in inflammable gases, may be placed under the grate, the heat causing the gases to rise and mingle with the air. The blast of air may be divided to aid in supplying pulverized or liquid fuel.

[*Drawings.*]

A.D. 1880, December 23.—No. 5396.

JOHNSON, John Henry.—(*A communication from Paul Gustave Louis Gabriel Designolle.*) — Treating compounds of copper, and separating copper from precious metals.

By applying the prior Specification No. 507, A.D. 1880, copper (as well as precious metals, if present) may be extracted by amalgamation from sulphurous, arsenical, antimonial, or oxide (rich or poor) ores or compounds, matts (with or without lead), or roasted pyrites ; previous partial or complete roasting being employed, or at least often advantageous. The cupreous substances are finely pulverized, either dry or with water, preferably in an iron drum or cylinder, rotating on a horizontal axis, made in two pieces for transport, and containing, say, 5 metal cylinders, their diameter being proportioned to the hardness of the ore and size of the drum. After the grinding or trituration, the liquid portion in the upper part of the drum is discharged by a valve, and the insufficiently-triturated portion remains to be further reduced with fresh ore and water. The liquid is conducted to several vessels or settling-tanks (with or without agitators), wherein the products are deposited in order of fineness, the too coarse portions being returned to the drum. The last tank has a double perforated partition, enclosing sponges, which only allow clear liquid to escape.

The ground material or pulp is placed in an iron amalgamating (resembling the triturating) apparatus, with enough water to produce semi-fluidity, and with bichloride of mercury proportioned to contain 1 equivalent of mercury to 2 of the copper (allowing also for precious metals in rich ores). Some chloride of sodium is added, and also some iron filings or sponge may reduce the wear of the metal drum. During, and partly to

complete, the amalgamation, mercury is added ; but about 4 times as much is desirable for subsequent operations as is required for the theoretical amalgam, Cu Hg. All the resulting highly-fluid amalgam is discharged through plug holes in the lower part of the drum ; its internal cylinders (or cylindrical chambers, which can turn freely within the rotating drum) having helical grooves, so that they only rest at certain points and the amalgam may easily escape ; but the apparatus may be modified.

Owing to the quantity of amalgam, it is placed in a mixing or pugging apparatus, having a larger upper and a smaller lower cylindrical chamber, the former of which has cast-iron rakes or stirrers on a vertical shaft. To the mass of amalgam etc. there is added about 5 times its volume of water to render it quite fluid : and under the agitation of the stirrers, the globules of amalgam unite and collect in the lower chamber. The mud or liquid, containing the gangue in suspension and a few remaining globules, is drawn off from the upper chamber through valves and passes to another mixing-apparatus, water being added so that the mass may be quite fluid when treated in a subjacent apparatus with stationary and revolving plates for collecting the remaining amalgam (in accordance with the prior Specification). The said shaft also actuates a helix or screw in the said lower chamber to stir the amalgam therein, while it is washed free from intermixed impurities, the water containing suspended gangue being replaced by pure water. Afterwards this amalgam is drawn off.

The amalgam obtained in both ways, when freed from all impurities, is highly compressed in a skin of chamois leather to extract as much mercury as possible, and then distilled to drive off the remaining mercury from the other metals. When a complex amalgam, wherein copper predominates, but also containing gold, silver, platinum, and other precious metals, is suitably distilled, the precious metals are stated to become separated below the copper, which forms a spongy mass above them, eliquation taking place, and the copper amalgam alone swelling when heated to about 300° Cent. The said compressed amalgam is therefore distilled slowly and carefully at first and without the heat ever rising beyond from 400° to 500°. After wards the cake thus obtained is divided along the clearly-defined line between the copper and the precious metals. The copper is pure, and may be melted and cast into bars, or be highly

compressed into "ingots." The precious metals retain a little copper and are refined. A furnace, containing a cast-iron case or chamber, has a movable plate or door facing a corresponding plate in the side of the chamber, in order to allow a kind of rectangular or other cast-iron crucible (with rollers running upon rails) to be inserted in the chamber. The lower part of the crucible is formed as an inverted truncated pyramid, in which the precious metals collect. The cover of the chamber has an escape pipe for the mercurial vapours, which are suitably condensed, and the metallic crucible is lined with peroxide of iron to prevent the cakes of copper from adhering to the metal.

[*Drawing.*]

A.D. 1880, December 24.—No. 5435.

WYLIE, Allan Carswell, and LOCKERBIE, THOMAS.—Regenerative melting-furnaces.

"The whole of the side flues for admission of the currents of " air and gas upon the surface of the molten metal are built " upon the main substructure of the furnace, and entirely " independent of the deflecting furnace roof. The entering " faces of the flue towards the furnace are made in a turned " arch, concave towards the hearth, and which may be made to " overhang the hearth at a considerable angle." The arches are fixed securely "by strong wrought iron stays or ties attached " to the body of the furnace, so that when the deflecting " furnace roof is built in between the flue faces, the latter " approach closely the sides of the roof," but do not rest upon it. Thus, if the roof collapses, the flue faces and flues remain firm. Owing to the overhang, the flues can be "set out to a " considerable angle of impingement upon the surface of the " metal bath."

By improving the substructure, the regenerator can be brought " directly under the escaping current of hot gases from the " furnace without weakening the arched substructure, instead " of through ports formed in the keying of the arches " supporting a principal part of the furnace." Cinder traps are formed "in the floor of the gas exit flues close to the furnace, " so that the bottom of the pockets is on the working floor " level." The hearth is supported on girders over a considerable

open area in "the substructure of the furnace, which com-"municates around the sides of the furnace bridges with "ventilation exits into the open air;" thus cooling the under side of the hearth and giving access for repairs.

The valve for reversing the action of the gases through the regenerator "may be of the ordinary D shape, travelling over "three ports; but instead of a sliding motion upon the port "faces," the valve is moved "by a rocking lever from beneath, "which thus lifts the valve slightly from one seat and drops it "rapidly upon the other."

[*Drawing.*]

A.D. 1880, December 28.—No. 5457.

MILLS, BENJAMIN JOSEPH BARNARD. — (*A communication from George Duryee*).—Metallurgical furnaces and processes.

Apparatus, modifiable for treating ores of and obtaining different metals and other products, may comprise a furnace for burning solid, liquid, or gaseous fuel, in communication with a slightly-inclined iron cylinder from 30 to 60 feet long and rotated upon rollers by means of gearing. The said fuel furnace may have a hearth or grate for burning coal, wood, etc., a blast of air being introduced underneath. The lower end of the cylinder has an annular flange fitting within a recess in the face of the furnace, so as to receive all the products of combustion therefrom. A compound blowpipe (having a nozzle for the passage of blast, concentrically within which is another nozzle for supplying petroleum or other liquid hydrocarbon or gas) is arranged in the wall of the furnace immediately opposite the lower end of the cylinder, so that a horizontal jet of combined air and liquid or gaseous fuel is driven across the flame in the furnace and an intensely-hot blowpipe flame is directed through the cylinder. The blast of air on its way from the fan is heated by traversing a pipe which is carried through the inclined smoke stack of the apparatus. Another pipe conveys liquid or gaseous hydrocarbon from a reservoir to the inner nozzle, the supply being regulated by a cock to produce an oxidizing or reducing flame. The cylinder is preferably lined with "a mixture of plumbago and asbestos "with molasses or other material to form a temporary bond. "This material is tamped in around a wooden core and burned,

" the heat destroying the core and vitrifying the lining into a " strong and continuous body." The upper end of the cylinder may contain projecting shelves to carry up the contents and drop them through the flame and gases. The lower end of the cylinder may have "an enlarged chamber or annular basin, " provided with holes for manipulating and discharging the " contents; said holes being closed by shutters when the " cylinder is revolved." There are also "peep holes covered " with mica." A feeding-hopper communicates by a spout with the upper end of the cylinder, and the ore thus introduced is caused to slowly descend against the blowpipe flame by its own gravity and the action of the revolving cylinder, which keeps it in motion and exposes it to the heat. The lower end of the cylinder may rotate in a suitable bushing in the wall of the fuel furnace. The latter may contain a transverse bridge or partition to separate one part, in which the solid fuel is burnt, from another part or receptacle, into which " ore or " other solid matter" or " melted ore" or metal and slag may be discharged from the lower end of the cylinder, the annular basin not being then used. There is a hopper, controlled by a valve and rod, " for containing powdered charcoal and common " salt to supply carbon and chlorine to the blast as it enters" the cylinder. Also ores may be thus deoxidized or chloridized in the said receptacle. " Any other gases, compound, or " powdered carbon" may be supplied to increase the heat of the flame. Sometimes finely-powdered ores may be fed in with the blast, or by means of a hopper at the lower end of the cylinder, so as to be carried up with the blast into the cylinder, when reduction is quickly effected.

For the distillation of gold, silver, and some other metals from ores, condensing chambers are employed, "provided with " blankets of asbestos or bodies of mineral wool or furnace " slag or any other proper material, against which the vapours " from the revolving cylinder are made to impinge." The blankets are by means of a tank kept moistened with a solution of sodium chloride, to precipitate silver and copper as chlorides, or other liquid may be used; a solution of sodium nitrate will collect sulphurous acid gas and form sulphuric acid, other bye-products being obtainable. The blast pipe may be carried through or close to the condensing-chambers, so as to heat the blast, and aid condensation by cooling the chambers. Wood

coke, or pumice stone may replace the blankets, and an exhaust fan be employed. Metals may be recovered "from their ores "by volatilization, effected by subjecting the ores while "agitated to the intense heat" of the compound blowpipe flame in conjunction with chlorine, and condensing the fumes or vapours produced. Auriferous and argentiferous sulphurets and other ores may be treated. As the ore descends through the cylinder, all vaporizable products are driven off into the condensers; and any metal, fused and not vaporized, will fall with the slag into the said receptacle and may be drawn off after settling. In treating copper and silver ores, the oxides may be driven off and the metals precipitated as chlorides by the chloride solution. Zinc, lead, and other metals may be driven off and condensed as oxides. Lead fumes are condensed as sulphates and oxides, to be remelted in crucibles with charcoal. "If the lead ores carry silver, the chlorine with the "blast eliminates the silver as a chloride; which settles to the "bottom of water tanks" provided in the condenser or outside. This precipitate is fused in crucibles with carbon and flux to obtain metallic silver. If copper and gold are present, the gold may be precipitated from the resulting solution of their chlorides (when it becomes saturated) by oxalic acid or sulphate of iron; or metallic copper may be separated by metallic iron, and then the chloride of gold be evaporated to dryness and fused with flux and carbon. A statement is given of the different temperatures at which mercury, tin, zinc, lead, antimony, silver, and copper and gold (the two latter respectively with and without chlorine) may be volatilized. In treating sulphuret ores, the combustion of the sulphur may produce much of the heat required. Again quartz rock, carrying large proportions of sulphide of iron and some gold, may be completely fused and desulphurized in a few minutes by using the blowpipe blast and hydrocarbon.

[*Drawing.*]

A.D. 1880, December 30.—No. 5498

SHEDLOCK, JAMES JOHN.—Protecting cast-iron articles from oxidation.

The articles are acted on by agents, such as dilute hydro chloric or sulphuric acid, which dissolve and form soluble salts

of iron. Thus "the surface iron is removed and a porous skin "of carbon or graphite is formed on the article." Next, the salt is removed from the pores of the skin by the action of hot or cold water or steam. Afterwards heat is applied to vaporize any remaining water, the vapour being removed by a pump or otherwise. A vacuum being formed in the airtight vessel wherein the articles are placed, communication is opened with a reservoir containing a solution of pitch, resin, india-rubber, or gutta-percha, which is forced into the vessel by atmospheric pressure and the pores of the skin are filled with the solution : so that, when the solvent is vaporized and withdrawn, the material which was in solution is left in the pores and a protective skin or covering is produced.

[*No Drawings.*]

A.D. 1880, December 31.—No. 5515.

LANDSBERG, ADOLF.—Crucibles and refractory vessels for the reduction and distillation of zinc, and for melting other metals and alloys.

The crucibles etc. are to be composed of an exterior layer of fireclay and an inner layer of graphite and fireclay, or of charcoal, coke, or coal and fireclay with or without graphite. The crucibles may be made simply of fireclay, their inner parts, where specially liable to corrosion by contact with the materials treated, being covered with a mixture of graphite and fireclay.

[*No Drawings.*]

1881.

A.D. 1881, January 11.—No. 121.

THOMPSON, WILLIAM PHILLIPS.—(*A communication from John Glassford McAuley.*)—Metallurgical furnaces.

A drawing is given of a furnace resembling a reverberatory furnace. Pulverized fuel is passed into a feeding-apparatus or

injector in the form of a metal tube connected at one end to a blower, the air pipe being contracted and carried beyond the entrance of the fuel pipe so that the fuel and air may be better mixed, and the vacuum produced in the injector draws air in through the fuel pipe. The injector, which can be also set at an angle, is flattened at the discharging-outlet to spread the air loaded with fuel over or above the bottom of the furnace; the fuel being forced into the furnace by the air blast. In lieu of grate bars, there is a bottom sloping from near the fuel inlet and from the top of the firebridge or bridge wall to the centre of the combustion chamber, which has an opening or draw-off for removing clinker at the lowest part. The firebridge is also sloped inside the "heating chamber," to prevent unconsumed carbon from collecting in the angle at the bottom of the bridge wall. A double combustion chamber with two injectors and two draw-offs may be used. A wedge-shaped wall is built between the two injectors, and a wall extends at an angle from them on each side towards the bridge wall, collection of carbon in the combustion chamber being prevented.

Conical mills for grinding the fuel in connection with the feeding-apparatus are described; or pulverized fuel may be conveyed through a hopper and funnel-shaped casing into the fuel pipe, a screw conveyer and valves regulating the supply of fuel and air.

[*Drawings.*]

A.D. 1881, January 12.—No. 135.

TAYLOR, William.—Stone-breaking machines.

The furrows and ridges of the reversible jaws employed, instead of being vertical and parallel, are to converge somewhat towards the upper and lower edges of the jaw and expand towards its centre. Thus most of the larger lumps are got rid of, as the converging grooves and ridges hold the materials until sufficiently crushed to pass between the smaller portion of the grooves.

The cracker-jaw, which swings on a hinge or pivot near its top, may be actuated by a preferably horizontal direct-acting steam cylinder, the piston-rod of which acts upon the lower end of the jaw. When the cylinder is vertical, the pressure can be applied through a wedge, bell crank, etc. To prevent the

thrust of the piston-rod from closing the jaw too far, a cross beam or stop may pass through a slot or equivalent in the jaw, by a screw or equivalent it can be moved up and down in bearings or slots in the framework to regulate the bight of the jaw, the stop and slot in the jaw being bevelled or slanted. A ratchet-wheel, worked by a pawl from the piston-rod cross-head, may transmit motion through its shaft and a belt or gearing to the ordinary cylindrical riddle, a second ratchet continuing the motion during the return stroke of the piston-rod.

Again, the jaw may be actuated by a method also applicable to double-action machines with jaws at each end. In this case the cracker-jaws are worked from an eccentric, driven by a shaft between them. The eccentric bears on each side upon friction rollers, working against smaller rollers in a block, which slides approximately horizontally in the framework and gives motion to the cracker-jaws, the jaws being withdrawn by a spring or otherwise. Here, two swinging wedges may replace the stop for regulating the bight of the jaws.

[*Drawing.*]

A.D. 1881, January 14.—No. 178.

PIEPER, Carl.—(*A communication from August Nagel and Reinhold Kaemp.*)—Sifting-apparatus.

An inclined sieve or riddle, made to oscillate on pivots by means of a cam or tappet wheel, is so arranged that products of various degrees of fineness may be obtained with one sieve and without altering the size of its meshes, the sifted product being finer in proportion as the sieve is shaken less forcibly, as its angle of inclination is increased, and as the operative surface for a given quantity of material is reduced.

The frame of the sieve is supported by journals, and it rests with the ends of its longitudinal bars on tappet wheels keyed on a shaft. These wheels, when rotating, alternately lift the frame and allow it to drop; thus it is shaken with an energy depending in the first place on the height of the tappets of the wheels, but the same may be varied by a cross-bar, placed below the sieve near its lower end, and adjustable in height by screws. Buffers may be provided on the cross-bar and on the longitudinal bars, where they cross one another; the buffers, coming

into contact, limit the height of fall of the frame. Thus the adjusted position of the cross-bar regulates the intensity of the shaking motion of the sieve.

To change the inclination of the sieve, the said pivots are adjustable in height; while they slide in guides forming an arc of a circle, the centre of which is at or near the centre of the tappet wheel. The adjustment may be effected by chains, to which the pivots are attached; or the latter may be provided with pawls, maintained by a counterbalance weight in engagement with the teeth on a curved guide. Also a pinion gearing into a toothed bow and provided with means for stopping its motion, or clamping-jaws to be pressed together on the curved guide by screws, or other device may be used. When the said inclination is altered, the cross-bar must be readjusted; for this purpose the bar may be guided in an arc of a circle, while its ends are pivoted in slide blocks, through which the adjusting-screws pass and which move in oscillating-guides.

To reduce the operative surface, the sieve may be made to assume a slight lateral inclination by raising one end of the cross-bar and the corresponding pivot. If the bar and the axis of the pivots are inclined in the same sense, the material slides towards one side of the sieve. But the said bar and axis may be inclined in a different sense; here the sieve forms a skew surface, in consequence whereof the material travels over it in an oblique course and also occupies only a part of it.

[*Drawing.*]

A.D. 1881, January 14.—No. 185.

LOVE, George, the younger.—(*Provisional protection only.*)—Metallurgical furnaces.

Flues are arranged at the sides of and adjoining or over the working door, to carry away the smoke and products of combustion from the fuel, as well as the fumes or gases arising from the heated metal under treatment. Thus also cold air, entering by the working door, is at once drawn away and prevented from chilling the metal or the interior of the furnace.

One or more fires may be used. Air to support combustion of the fuel may be admitted from under the heating-chamber or from the front or otherwise.

[*No Drawings.*]

A.D. 1881, January 15.—No. 206.

BARRY, EDWARD ARTHUR.—Calcining-apparatus.

A mechanical and regulated forward delivery of the ore or other material for treatment upon and along the bed of a roasting or calcining furnace may be effected by a set of scrapers having a short reciprocatory, horizontal and vertical, motion. The furnace consists of an elongated chamber, with a charging-hopper at one end, and an inclined outlet or shoot for the delivery of the ore after treatment at the other. Along the bed a series of transverse scrapers are located, each nearly fitting the space between the side walls. The scrapers are supported by longitudinal bars, the ends of which are carried by the cranks of shafts mounted and working outside or inside, or one outside and the other inside, the furnace; while auxiliary cranks and rods may be employed according to the length of the furnace in carrying the bars at intermediate points. Discs, to which these rods are attached, bear against friction rings let into the sides of the furnace around apertures, so that the rods can move without air entering the furnace. The shafts are rotated simultaneously in one particular direction by gearing and connecting-rods. The longitudinal bars are mounted loose upon the cranks of the shafts and have slots at their ends, so that they partake fully of the horizontal reciprocating motion of the cranks, and accommodate themselves in the up-and-down motion. Thus the scrapers may rest for part of the horizontal movement in contact with the bed or nearly so, and push forward some of the ore; then they rise out of the ore and return above it, to be again lowered and push forward the portion of ore deposited by the preceding scraper. To prevent air entering by the slots through which the bars pass at the end of the furnace, the slots are covered by sliding plates working between guides, which are attached to a plate let into the end wall. The bars pass through the sliding plates, which move vertically to suit the movements of the bars. The ore during its progress through the furnace is calcined by artificial heat, by its own ignition, or by both means.

Again, the motion of the bars and scrapers may be obtained by eccentrics or by cams of predetermined shape, whereby a preponderance may be given either to the vertical or the horizontal motion of the scrapers, or some parts of the motion may be

quicker than others. Or the vertical and horizontal motions, respectively, may be imparted by separate mechanism. Where the calciner bed consists of several shelves one above the other, each shelf may have a set of scrapers so moving that, if the ore on the top shelf is moved from left to right, that on the second shelf is moved from right to left, and so on till the ore leaves the calciner. The gearing employed may work the apparatus with a continuous or intermittent motion.

[*Drawing.*]

A.D. 1881, January 21.—No. 277.

BRANDON, Raphael Hunter. — (*A communication from Emory Bassett Hastings, Joseph F. Holbrook, and Robert Lewis Goddard.*) — Ore-separators, including magnetic machines.

The stamped ore is discharged through the adjustable aperture of a feed box (by the aid of a toothed feed bar, to which a longitudinal reciprocating motion is given by a lever etc.) on to an endless wire cloth or other porous apron, carried round two revolving drums. A blast box, located transversely across the machine between the upper and lower portions of the apron, may be provided with two exit air passages just beneath the apron, above which are corresponding openings in an air suction box communicating with an exhausting-fan. A fan also supplies air to the blast box. As the ore is conveyed along upon the porous apron, the blasts of air from the subjacent box rising through the apron carry upward the light portions of material, which are drawn into the suction box. The remaining heavy portions are conveyed onward, and, if the ore be magnetic, it is then acted on while passing with the apron round a revolving drum of the following construction. This drum has a hollow shaft within a tubular wooden casing, and upon the outer surface of the latter are secured magnets, which are arranged in longitudinal rows and are " provided with a " segmental shaped armature secured in the slotted point of " each of the magnet cores." The surface of the drum is thus composed of magnet armatures, which "are so arranged that " the end of one stands opposite, or nearly so, the centre of the

"adjoining one"; thus a more unbroken armature-surface is formed. Through perforations in the hollow shaft, bushed with insulating-material, are fixed four metal posts, which are connected to copper or other bars, fixed and insulated in the ends of the shaft. Wires, held in contact with the outer ends of the revolving bars, communicate with an electrical generator; and wires, which are wound round the different magnet cores, are connected to the said posts. As the material upon the apron comes within the magnetic field, the ore will adhere and be carried round until the apron leaves the drum, when the ore (or metal) will drop from the apron at the rear of a spout, into which the other (sandy or rocky) material has meanwhile fallen, this spout being placed under the drum and having one side adjustable there. Permanent magnets may replace the electro-magnets.

[*Drawing.*]

A.D. 1881, January 22.—No. 280.

KOPPEL, William.—(*Provisional protection only.*)—Alloy.

An alloy, having various uses (bearings for axles, etc., being mentioned), may be made with from 18 to 20 parts of spelter, 10 of iron, and 10 of copper. It may considerably resist corrosion.

[*No Drawings.*]

A.D. 1881, January 22.—No. 290.

BINON, Joseph, and GRANDFILS, Alphonse.—"Smelting "of zinc."

Zinc ore is mixed with the coal or other carbonaceous reducing matter and, if needful, to make the mixture cohere, with lime, cement, clay, etc. The mixture is pressed or moulded into bricks or blocks, which can be hollow or perforated, and are preferably made to fit within the retort or muffle, wherein reduction is effected by heat as usual. Thus the feeding of the retort is facilitated and its capacity better utilized, and more complete reduction is obtained.

[*No Drawings.*]

A.D. 1881, January 22.—No. 298.

SCHEIBLER, Carl.—Refractory magnesian products.

Magnesia, obtained as described, may be used for producing basic linings, bricks, &c., which, in contradistinction to lime-containing linings, do not crumble in the air or in water either in the air-dried or in the burnt state. Magnesia or hydrate of magnesia may be obtained from magnesiferous limestone, magnesian limestone, or calciferous magnesite by using a water solution of sugar or molasses to dissolve the lime after the material has been burnt, the magnesia and impurities, such as silicic acid, alumina, or iron oxides, remaining undissolved. These impurities become deposited on the bottom of the clearing vessel and are easily separated from the magnesia layer above. Before being mixed with the sugar solution, the burnt material may be slaked with little water to produce a pulverulent hydrate of lime.

[*No Drawings.*]

A.D. 1881, January 25.—No. 328.

ORR, John Bryson.—Obtaining metals.

The inventor refers to his prior Specification No. 517, A.D. 1874, which relates to producing a white pigment.

According to the present invention (by which a better pigment is obtainable), poor zinciferous ores containing blende or calamine combined with other metals, but too poor or unfit for ordinary metallurgical treatment, such as common bluestone ore containing from 25 to 30 p. c. of zinc, are finely pulverized and roasted "sweet" on the bed of an ordinary calciner. The resulting mass is lixiviated with water to extract the zinc existing as sulphate, and then the insoluble portion is treated with dilute sulphuric acid or hydrochloric acid to exhaust the remaining zinc. Any copper in the ore is extracted at the same time. These solutions are mixed together, and the copper is extracted by known means. The ores, from which the zinc, copper, etc. have been thus extracted, may then be smelted to obtain the lead and other remaining metals. The production of a white pigment from solutions of zinc salts and of sulphide of strontium is described.

[*No Drawings.*]

A.D. 1881, January 25.—No. 334.

BURNS, David.—Washing and separating ores etc.

As an improvement upon the prior Specification No. 1244, A.D. 1877, the machine may comprise a tank or box, which conveniently has the form of a rectangular prism terminating downwards in a rectangular pyramid. Throughout the length of the prismatic part of the box, and in the middle of its width, stretches a tube, preferably of heptagonal section, and with one of its sides downwards and horizontal. Throughout the length of this bottom side is a trellis or equivalent valve, which is opened and closed by means of a horizontal rod, working through stuffing-boxes, and receiving reciprocating motion from an eccentric or other mechanism. Above the tube, and stretching throughout the extent of the box, is a horizontal perforated plate or grating with apertures rather larger than the largest particles of ore to be treated. Iron bars, crossing the box, strengthen and support the plate, which also rests on a flange on the inner side of the box. The said tube is supplied with water at a constant pressure by a pipe which has an air chamber to give regularity and elasticity to the action of the water. As the said valve opens and shuts, it causes the water under pressure to flow intermittently into the box and so fills it, and with a pulsating action it rises through the perforated plate and agitates the ore thereon, which is fed into the box from classifying-sieves. The ore being thus raised and allowed to fall, its lighter particles tend to come to the surface and are washed over into settling-pools or elsewhere, while its heavier tend to the bottom and, passing through the perforated plate, collect in the lower part of the box, whence they are removed at intervals by a valve.

To make the valve adjustable, so as to regulate the force of water to suit different kinds of ore etc., two plates run the whole length of the trellis valve face, and may be moved in parallel lines towards or apart from one another by means of right and left hand screws on shafts, which can be moved synchronously by means of wheels shown in a drawing as connecting the shafts together. Thus the openings, through which the water flows, may be made larger or smaller and the quantity and force of the water be varied accordingly. The arrangement of pipe described gives an equally diffused and balanced action of the water through the perforated plate and on the ore treated.

[*Drawing.*]

A.D. 1881, January 26.—No. 341.

KING, John Thomson.—(*A communication from Charles Forster.*)—Rock and ore crushers and pulverizers.

One jaw or working face has a lateral vibration or crushing and grinding motion across the face of the other jaw or die. The fixed die is mounted in a frame cast at one end of the bed of the machine, and has a pivot-bearing on its back which fits into a recess in the frame. The base of the die is slightly inclined at the back, and rests against a taper or wedge bar for throwing out or drawing in the die to lessen or enlarge the opening between the dies, according to the fineness to which the ore or other material is to be reduced. After adjusting the die, it is firmly locked by two wedges driven between wings on the die and the frame of the bed. The movable jaw with its die has a pivot extending down into a seat in the bed, while a hollow semicircular bearing on the bed extends up around the pivot and within the jaw to enable it to withstand the heavy crushing strain. The jaw has a long arm extending back over the bed and resting at its end on a plate on the bed. Power connections cause the arm to reciprocate and the face of the movable die to vibrate laterally across that of the fixed die. The movable die is kept in place in the jaw by an upwardly-tapering dovetail connection being slipped in from below and held in place by pins passing over the top of the jaw into recesses in the back of the die: then Babbit or like metal is run in to fill the space between the die and jaw, and the die cannot be raised by the crushing strain. A hollow semicircular lip projects downwards at the base of the die and prevents pulverized ore from working into the journal of the jaw. The face of the fixed die is arranged on an incline and that of the movable die about perpendicular, the space between them gradually diminishing towards the base of the dies where the reduced ore is discharged.

For crushing only, the face of the fixed die has two corrugations formed of two hollow parts with a central rib between them, while that of the movable die has two corresponding corrugations formed of two cheeks with a recess between them opposite the rib. Extending longitudinally across the corrugations are series of angles, generally about three on each corrugation: these angles on the cheeks form projections and on the hollow parts angular depressions, the dies thus obtaining

a firm bite or hold on the ore. Extending from about the centre of the dies to their bases are series of longitudinal lips, which gradually increase in height towards the base where they extend furthest from the die. The spaces between are slightly broader than the faces of the lips, which on each die are opposite the spaces on the other, the lips on the movable die breaking joint with and playing into the spaces on the fixed die when they are set close. The lateral vibration causes the cheeks on the movable die to alternately approach and recede from the hollow parts on the fixed die, the cheek on one side approaching when that on the other recedes. The ore, fed in between the dies at the top, is caught in the angular faces of the dies and crushed between them. As the ore falls it is caught by the lips and given a final break, being tilted or thrown over so that no long pieces can pass until small enough to traverse the spaces between the lips ; more uniform crushing is thus effected.

For both crushing and pulverizing, the upper parts of the dies are similarly formed, but towards the base of the fixed die the central rib fades away and leaves a concave slightly larger than an arc of a circle described from the pivot of the movable jaw. The base of the latter extends out to form a convex, fitting into the said concave and having a slightly smaller arc than it. Across the face of the convex is a set of tapered pockets, into which the crushed ore falls from the upper part of the dies : while between and below the pockets is a series of angular crushing and grinding edges, between which the die is cut away to form clearances, whereinto the pulverized ore falls, being thrown out by the lateral movement of the die. By forming angles or serrations at the base of the die and the crushing-edges along these serrations the delivering surface of the dies is increased ; they can thus pulverize and deliver more than double the amount where a straight base is used. To prevent unpulverized ore from passing on either side of the movable die, or pulverized ore from passing into and clogging the bearings of the jaw ; a false plate is placed within the bed frame on either side of the movable die, and is adjusted by screws against the die face so as to close the opening on either side. The convex base of the movable die vibrates laterally with a crushing and grinding motion within the concave of the fixed die. The ore, crushed by the corrugations, as above described, is crushed still smaller as it sinks between the dies till

it can fall into the said tapered pockets, whence it is fed and is caught between the face of the fixed die and the grinding-edges of the movable die, which thoroughly pulverize it, and by the lateral motion it is thrown out into the clearances between the edges and drops into the discharge.

The dies are generally of cast iron, but for pulverizing pottery clay etc. may be made of stone, glass, clay, or other non-metallic refractory material.

[*Drawing.*]

A.D. 1881, January 28.—No. 386.

LAKE, William Robert.—(*A communication from Thomas Arnold Jebb and William Thomas Jebb*).—Washing granular material in the manufacture of starch etc.

A vessel is provided having a cover with a central feed opening, and a conical spreader which distributes the grain to the circumference of the vessel. The bottom of the vessel is conical, the lower part being perforated and terminates in a discharge spout with a valve. The vessel is filled with water, and the grain to be treated is introduced, and in descending through the water becomes washed, the dust etc. rising to the top of the water being carried away through an overflow channel.

[*Drawings.*]

A.D. 1881, January 31.—No. 414.

LAKE, Henry Harris. — (*A communication from Jean Baptiste Mallion Fillon and Carlo Lavelli de Capitani.*) — Refractory basic materials for lining furnaces etc.

To obtain a product which will resist a temperature of 1200° Cent., native or natural carbonate of magnesia is pulverized, calcined at a higher temperature than the above, and mixed in about the proportion of 70 or 80 p.c. thereof with 15 of silicate of alumina or aluminous earth and 4 or 5 of quick lime. For a product to resist the action of acids, the calcination is raised to 1500° Cent., and from 70 to 80 p.c. of the calcined magnesia is mixed with 10 of " uncalcined magnesia " and of quick lime, respectively.

For making bricks for lining or for forming the hearth or bottom of furnaces employed in dephosphurizing iron or steel, the purest pieces of the natural carbonate of magnesia are pulverized, calcined at from 2000° to 3000° Cent., and mixed in the proportion of from 80 to 95 p.c. thereof with quicklime. Or the same method may be pursued as in making a composition to resist acids.

The various mixtures are moistened by the addition of gluten or heavy oils, and placed in moulds, and considerable pressure is applied to form articles.

[*No Drawings.*]

A.D. 1881, February 1.—No. 426.

BOULT, ALFRED JULIUS. — (*A communication from John Conant.*)—Manufacture and treatment of metals.

In making, tempering, hardening, refining, toughening, welding, and working steel, iron, and other metals, a compound or mixture of about $3\frac{1}{2}$ parts by weight of sulphate of copper, 4 of rosin, and $2\frac{1}{2}$ of sal ammoniac may be used in solution or powder, and usually the sal ammoniac is mixed with borax. The metal, "within the limits of a dull red and a white heat "sufficient to melt the copper and absorb it or the compound," may have the powder or solution applied to it by rubbing, dipping, or otherwise, so that while the metal is being pounded on the anvil it becomes more or less thoroughly impregnated or incorporated with the compound, the repetition of the process increasing the result. Subsequently the metal may be chilled or hardened as usual or in a bath of the solution. The compound "can be used effectively and successively in and from the fusion "of metals up and through their formation into manufactured "goods:" and "the sulphate of copper is unified with the "other metals." Other salts of copper can be used, as well as other resinous matters.

[*No Drawings.*]

A.D. 1881, February 4.—No. 488.

ALLPORT, CHARLES JAMES. — Moulds for casting ingots under pressure.

To make tight joints between the mould and the bottom

upon which it stands, and its lid, respectively, and between the different parts of the mould if made in more than one piece, so as to overcome the difficulty of subjecting the metal while it sets in the mould to pressure from steam or gas, the inventor employs a packing of strips or rings of asbestos millboard or cloth, or asbestos fibre made into a gaskin, or asbestos made up in other forms. Sometimes grooves are formed in the surfaces to be joined, and a gaskin of asbestos rope is laid in the grooves.

[*Drawing.*]

A.D. 1881, February 9.—No. 544.

ADAMSON, Daniel.—Consolidation of copper and other ingots, and working of metals etc.

" The consolidation of molten copper, cast iron, steel, or " wrought iron in welding condition" may be effected. "Direct " steam force upon a large area of piston" is employed, sometimes with a small percussive force. "In one case the steam " cylinder is above the work and attached to the bed or " foundation plate direct by uprights, while the force is com- " municated to the metal to be consolidated by ram or rod " direct from the steam piston to the metal upon the base plate. " Such metal may be either in an ingot box or case, or " unprotected." Again, the pressure may be transmitted from the bottom of the apparatus direct against the top or entablature, adjusting-appliances being sometimes employed in keeping the metal in position. "For the consolidation of steel " or copper ingots or other molten or semi-molten metals, no " adjusting appliances would be necessary." The press may be vertical, horizontal, or angular. For consolidating steel ingots, on admitting steam on the top of the piston of the cylinder, " the ram descends on to a plunger which fits loosely in the " ingot box," and "the pressure is continued until the metal is " consolidated and made free from blow holes."

[*Drawings.*]

A.D. 1881, February 9.—No. 562.

JENSEN, Peter.—(*A communication from Thomas Alva Edison.*)—Carbon crucibles etc.

To manufacture pure and flexible carbon in any desired shape

(particularly for incandescent electric lamps) ; thin sheet metal which will stand high temperatures, like sheet nickel or cobalt, is formed into the shape desired for the finished carbon (or shaped wire may be used) and then suspended in a closed flask. The vapour of a volatile carbon, preferably bisulphide of carbon, chloride of carbon, volatile paraffins, or naphtha, is passed through the flask while highly heated until carbon has become deposited upon the metal shape to a sufficient thickness. Subsequently the shape is immersed in acid to eat away the metal and leave the pure carbon. Again, to produce carbon sheets etc., a number of sheets of paper are placed between plates of metal and the whole is heated in a flask or retort until all the constituents of the paper, except carbon, are driven off. To produce crucibles, dishes, and other hollow ware, paper may be pressed into a mould by a plunger (the plunger and mould having the shapes desired for the interior and exterior of the article) and carbonized between the moulds : or paper pulp or dampened paper may be struck up by a plunger and mould, then dried, and afterwards carbonized.

The invention further relates to carbon conductors for incandescent electric lamps.

[*Drawing*].

A.D. 1881, February 14.—No. 623.

BROWNE, Alexander.—(*A communication from Herbert Strickland.*) — (*Provisional protection only.*)— Separating metallic minerals from each other and from non-metallic substances.

In one or more troughs placed in a slanting position, there are fixed one or more chambers, with adjustable fronts and backs, having, say, three adjustable diaphragms or partitions placed therein in a vertical position at about equal distances asunder, the middle one extending to the bottom of the chamber and over a small hole therein, but this partition is tapered towards both ends so as to divide the hole into two equal parts ; the other two partitions only extend about three-fourths down the chamber. Over the middle partition (preferably in the first chamber only) are fixed one or more

water-supply cocks, so water rushes down both sides of the partition.

The materials for treatment may be sifted in the upper end of the said trough, being there regularly supplied in a granulated form. Water is admitted, and carries the material along the trough and into the first separating-chamber through one or more holes therein. The water rushing down the middle partition flows under the bottom of the other two partitions and out of the chamber along the trough, in which it meets the main current, and into the following chamber, carrying with it the lighter portions of the material; while the heavier pass through the small hole in the bottom of the first chamber, and so on in each of as many other chambers as needful. The force of the rising column of water, which effects the separation, is regulated according to the specific gravity or nature of the material treated; as by sliding either of the adjustable partitions higher up or lower down the chamber, and having a sliding piece on the top of the centre partition, also by sliding the adjustable fronts and backs of the chamber to suit requirements.

[*No Drawings.*]

A.D. 1881, February 17.—No. 701.

CLARK, ALEXANDER MELVILLE.—(*A communication from Jean Baptiste Marie Prosper Closson.*)—(*Provisional protection only.*)—Refractory magnesian products.

Reference is made to the prior Specifications No. 4253, A.D. 1879, and No. 5365, A.D. 1880, the former of which relates to manufacturing magnesia by means of calcined dolomite and various chlorides, including waste residues. From the chloride of magnesium produced at first with chloride of calcium, there may be precipitated the magnesia by treating with more dolomite, or the separation of the magnesia may be otherwise effected.

Magnesia obtained by means of the present invention may be used for manufacturing refractory products, as in accordance with the secondly-mentioned prior Specification. In making refractory products for use in the metallurgy of steel, for which their physical strength is very important, a little

phosphoric acid (in the form of phosphate of magnesia or other base) may be sometimes added to the plastic mass, the product being sufficiently refractory and exceptionally hard.

In producing magnesia in accordance with the first-mentioned prior Specification, impure dolomites may be treated "by "slaking after burning and mixing up and stirring with water" to separate by deposition much of the clay, oxide of iron, and sulphate of lime, calcination with charcoal or coal sometimes effecting separation of the latter in the dry way. Preliminary grinding of the raw dolomite may be employed for separating impurities by the wet way or by classifying the dust by a current of air. By adding a little sugar (molasses) to the liquors employed, a saccharate is formed with the lime of the dolomite and is decomposed by the chloride of magnesium, yielding magnesia and chloride of calcium, while the sugar set free re-forms saccharate of lime. Thus, a pure magnesia is rapidly obtained free from lime.

In making sugar or treating molasses, wherein saccharates are formed, calcined dolomite may be substituted for lime and the separated magnesia be collected.

Sugar forms several saccharates of lime, and by taking advantage especially of the action of changes of temperature upon the solubility and constitution of the saccharates, the separation of the magnesia and lime of calcined dolomites may be effected. By treating the dolomite with sugar, a saccharate of lime becomes formed and the magnesia is obtained as a deposit. On applying changes of temperature, the saccharate of lime "plays the part of a sponge absorbing the lime at a "certain temperature and giving it up at another;" the same sugar and saccharate being used again.

[*No Drawings.*]

A.D. 1881, February 19.—No. 723.

MALTBY, JOHN CHADWICK and BRADFORD, GEORGE.—(*Provisional protection only.*)—Coating metals.

A method of depositing one metal on another without the aid of electricity.

The article upon which the metal is to be deposited is immersed in a solution containing aqua fortis or other suitable

acid, and water, in which also is placed a quantity of the metal to be deposited.

[*No Drawings.*]

A.D. 1881, February 28.—No. 840.

COOKE, Bryan George Davies.—Constructing the internal parts of cupolas, furnaces, retorts, etc.

Those portions which are usually made of burnt firebrick are to be formed of unburnt blocks or bricks of silica or silicious rock in combination with alumina, lime, or other cementing-matters (including fireclays), moulded under great pressure so as to bear handling etc. The blocks, after erection, become one homogeneous mass when acted on by the fire. The cupolas etc. are more free from flaws and durable than usual, and expense is saved. The cementing-matters may be dispensed with, if the silicious material itself contains sufficient binding-matter. Lime mixed with water may be incorporated with crushed silicious rock, and the mixture be allowed to dry till of the proper consistency for moulding.

[*No Drawings.*]

A.D. 1881, February 28.—No. 847.

GEDGE, William Edward.—(*A communication from Louis Thénot.*)—Treating auriferous, argentiferous, and other ores and matters.

Gold may be extracted from quartz, sand, and soil by passing the same in a stream of water through columns of quicksilver having columns of water above them ; the process being applicable to the ores of silver or any metal which may be treated by amalgamation or by mechanical separation like platinum. The apparatus has one or more sections or separable parts, each comprising two vertical tubes, a descending and an ascending tube of different form and diameter, which are united below by a basin having two elbow pipes ; while by other elbow pipes or joints the ascending tube of one section is united above to the descending tube of another so that the different sections are connected. The outlet end may communicate with one or more horizontal or slightly inclined, jointed, tubular divisions, beyond which is a discharge pipe. The apparatus, the different parts of which may be movable on wheels, is provided with charging-orifices,

covers and doors, regulating and discharge cocks or valves, guages, inspection windows, and adjuncts for working with pressure or exhaust (or both) produced by columns of water, suction or force pumps, or other means. The vertical tubes and horizontal divisions are charged to a certain height with quicksilver, and then the whole apparatus is filled with water. When working with pressure, a mixture of the ore for treatment and water starts from a reservoir placed so high as to determine the slow and continuous progress of the mixture in the apparatus. The mixture traverses the descending and ascending tubes in turn, and passes alternately through columns of quicksilver and columns of water. The resulting agitation and intermixture may be increased by placing obstructions in the ascending tubes; which have a large section at the upper part whereby the current is reduced. The quicksilver retains the metallic parts which, being dense, remain at the bottom of the basins and amalgamate, and platinum will here remain. The lighter particles rise through the quicksilver and lie on its surface, where amalgamation may be completed, and the globules of quicksilver formed by the agitation also separate from the water in the upper part of the ascending tubes. The residual matters pass on, and the surfaces of the quicksilver baths in the horizontal divisions (which may be united by elbow pipes) are licked by the quartz-loaded currents, the exhaustion of the matters being thus completed and any remaining globules of quicksilver retained. When working with exhaust, the feed pipe should have a float valve to close automatically when the supply of the said mixture ceases; so as to keep the apparatus always primed; it forms a kind of siphon. Disengagement of air from the water in the upper parts of the apparatus may be provided for, as by a closed vessel of water with two tubes, one of which leads air up into the vessel while the other conveys water down into the apparatus. In methodical working, the first section is removed when the quicksilver within it is sufficiently saturated, the others are brought nearer the feed pipe, and a section charged with virgin quicksilver is introduced before the horizontal divisions. The vertical tubes and horizontal divisions may be used separately or combined; and the current leaving the apparatus may pass over amalgamated plates, which will retain any escaping fine particles of quicksilver.

[*Drawing.*]

A.D. 1881, March 1.—No. 873.

MORGAN, THOMAS HENRY.—Cleaning tin and other metal plates.

The apparatus consists of a horizontal framework divided into divisions in which are placed alternately pairs of rollers and rotary brushes driven by any suitable power, and provided with adjusting-screws. A hopper contains bran or other similar material, and is provided with two sets of openings, one of which communicates with a space below the hopper where the plate first enters containing fixed brushes, the other with the first pair of revolving brushes. The plate is introduced horizontally and first passes through the bran in the chamber, thence between the first pair of revolving brushes, then between a pair of fixed brushes or a pair of hide scrapers; it is then seized by the first pair of rolls, and is carried forward between the rolls and brushes till it is delivered at the other end of the apparatus. Guides are placed between the rollers and brushes to guide the plate forward. A receptacle is provided below the first pair of brushes to retain the bran and supply the lower roller. The bran is returned to the hopper by the ordinary methods.

[*Drawing.*]

A.D. 1881, March 4.—No. 930.

KIRK, ALEXANDER CARNEGIE, and SIM, ROBERT.—(*Letters Patent void for want of final Specification.*)—Metals, cleaning, preparatory to painting or coating.

The surfaces of ships' hulls or other steel structures are coated with a paste formed of clay, calcium chloride, hydrochloric acid and water. When the scale is dissolved the paste is washed off by water and milk of lime. The clay may be replaced by other earthy or vegetable thickening matter, and the calcium chloride by glycerine or other hygroscopic substance.

[*No Drawings.*]

A.D. 1881, March 5.—No. 958.

LAKE, WILLIAM ROBERT.—(*A communication from Philipp Anton Fauler.*)—(*Provisional protection only.*)—" Cupola and " similar furnaces."

Such furnaces, for treating copper, nickel, and other ores, may

be constructed with a number of superposed sheet-iron cylinders or rings ; a circular blast conduit being placed between two of the cylinders. In the front of one cylinder is the tapping-hole, and at its rear the opening for removing dross or scoria. The cylinders are lined with refractory material. Inside the cylinders and at the lower part thereof are fixed "circular T-shaped " pieces of iron ; and at the top and outside circular iron " angle-pieces are fixed to the said cylinders. The inner wings " or arms" of the T-shaped pieces support the lining, while " the outer wings are bolted together with the angle pieces." By means of the said conduit, the blast obtains access in a concentric manner to the furnace. The conduit has openings or registers, provided with coloured glass, for inspecting the operation and for cleaning the blast entrance. The lining can be repaired away from the furnace, and interchangeable cylinders be provided which will fit perfectly in their places ; a defective cylinder may be withdrawn and replaced by another without replacing the upper part of the furnace. The blast conduit admits of the molten metal being kept within a small zone at a high and uniform temperature, and the melting operation is effective.

[*No Drawings.*]

A.D. 1881, March 9.—No. 1012.

HUNTLEY, Benjamin Ralph.—Metallurgical furnaces.

A furnace is formed of brickwork, preferably with an iron casing. The receptacle for the fire is like a basket with open sides and bottom, which facilitates the supply of air for combustion. There are air channels or flues in the top part of the furnace or along each side, and at the bottom or beneath the floor ; they lead to pockets communicating with the fire-grate or basket, so that air, heated in passing through the flues, is supplied to the fuel. Below the firegrate there is sometimes a perforated hearth, "and under and over this hearth an air cell " is arranged : these cells as well as the grate side pockets" have doors to regulate the supply of air. A firing-hole is made, preferably in the front wall. "Air cells are also arranged " running up to and at the bridge," the heat being intensified and smoke consumed. The products of combustion, after

passing over the floor, may be sometimes led to an underground flue and thence to the chimney.

A double furnace may be fed from one fire, return channels being provided so that the unconsumed gases, after passing over the furnace floor, may return to the firegrate for "recombustion." Steam, hot air, or both may be supplied at the centre of the bridge, and air may be admitted elsewhere. A drawing of one double furnace shows two adjacent floors or beds with charging-holes at opposite sides. Other furnaces are shown as having a sloping and a horizontal grate, composed of longitudinal bars. A furnace for heating ingots &c. or making steel is shown as having two end exit flues ; or "the stack may be placed on the " crown or other part of the furnace." Doors close in the grates. There are charging-holes at either or both sides.

To check injury to the iron by cold air entering through the rabble hole in the charging door of a puddling furnace, the door is formed partly hollow and provided with a flue communicating with one of the above-mentioned flues leading to the fire-chamber.

An ingot-heating furnace has charging-doors at the front side (and ends), the firegrates extending the whole length of the opposite side. Exit flues, apparently commencing near the charging-doors, lead to an underground main flue. The roof of the furnace may be supported by pillars at intervals.

Arrangements of firebars and bearing bars are shown. The former may be "formed round in the centre with a number of " cross pieces." They may have square ends so as to be turned by a key for "scarring" purposes.

[*Drawings.*]

A.D. 1881, March 10.—No. 1036.

JOHNSON, JOHN HENRY.—(*A communication from Charles Pernot.*)—Gas furnaces etc.

The conduit leading from the generator or other source of gas to the furnace is provided with means for applying pressure to the gas, such as a fan, piston working in a cylinder, or injector ; and thus, while any kind of fuel may be used to produce the gas, the quantity of gas produced and employed and the temperature of the apparatus to be heated may be

varied, the yield of the apparatus being also varied. The air can be supplied to the working chamber of the furnace under the same pressure as the gas, as by mounting the fans for respectively supplying the air and the gas upon the same axis. In Pernot's furnace (for making steel) the mixture of gas and air is delivered at right angles on the sole or hearth, which is rotated, and the effect will be like that of a blowpipe, a very high and uniform temperature being produced, whereby fusion is accelerated and the yield increased. The invention enables several furnaces to be worked under the same conditions, when it is essential that their contents should be ready at the same time, to obtain the quantity of metal for producing very large masses or ingots.

[*Drawing.*]

A.D. 1881, March 11.—No. 1049.

MATTHEWS, David Perfitt Griffiths.—Pickling and cleaning metal plates etc.

The bath is rectangular and may be of metal or wood lined with lead. It is suspended from a chain, which passes over a pulley to a winch, by which the bath may be raised or lowered The weight of the bath is balanced and its movement is guided by guides running in brackets fixed to the bath. The liquid in the bath is heated by steam admitted from a perforated pipe, such pipe being provided with a suitable telescopic coupling. The heat of the pickle or other liquid and the density thereof are indicated by a thermometer and hydrometer fitted to the bath. In the bath a perforated table is suspended and carries a series of grooved rollers which may be rotated by chain gear.

The plates or other articles to be treated are placed in tiers or otherwise in open crates formed with corner-pieces and removable side rails. The bottom rails are formed with notches into which the plates are dropped, and between the plates may be inserted a copper wire or rod, or corrugated or woven plates to keep them apart. This wire or other material is arranged so as to be easily removed after the immersion to allow the plates to be handled in a mass.

The crate when loaded is placed upon a perforated platform on a carriage running upon rails. The platform and crates on

reaching the bath are run on to the rollers upon the table in the first tank, and after immersion in the first bath are passed on to the second, and then on to another carriage similar to the first on the other side of the second bath.

The apparatus may be arranged so that the baths remain stationary, whilst the tables and the cradles on them are dipped into the baths. The tables may be omitted and the rollers carried by suspended rods, the platform and crates being run on to the rollers and dipped into the baths.

In a modification of the invention the bath is circular, and is supported so that it may be raised and lowered as above described. The table is carried upon a fixed support, which passes through a stuffing box in the bottom of the bath. The crates are mounted on wheels which run on rails, and in the centre of the table is a turntable by which the crates may be turned into the direction required.

In another arrangement four rectangular baths are arranged around a central turntable ; the baths are hung from crossheads and chain by which they may be simultaneously raised or lowered.

The baths or tables in either arrangement may be arranged to counter-balance each other. The moving part may be arranged to open and shut a cock, whereby a sufficient quantity of acid is admitted to the pickling-bath to replace that carried off in each operation, and to keep the liquor at the proper strength.

When the apparatus is used to remove grease from tinned articles, the bath may contain a hot or cold mixture of soda and water or other solvent. The bath in this case is preferably stationary and the articles are washed by the up and down movement of the crates. The grease will rise to the top of the liquid, and should be removed whilst the articles are in the bath by skimming or by admitting a sufficient quantity of liquid to cause the grease to flow over into a trough provided for its reception.

[*Drawings.*]

A.D. 1881, March 11.—No. 1063.

JOHNSON, JOHN HENRY.—(*A communication from Simon Philippart.*)—(*Provisional protection only.*)—Treating ores, etc.

Ores or mineral masses of all kinds are to be so treated as to

place the metal in chemical or mechanical suspension in a liquid. Thus, the stamped, ground, or otherwise reduced ore, for example, malachite or pyrites when treating cupreous ores, may be acted on by sulphuric acid to produce a liquid holding in chemical suspension as sulphate of copper the whole of the copper in the ore. The liquid is then placed in the outer vessel of a battery, and electrical action begins when the inner vessel is filled with the complementary liquid, in this case sulphate of iron. There are thus produced copper and peroxide of iron, and the copper is reduced or converted to the form of an ingot by suitable means. The process applies to all electrolytic metals, one metal being produced at one pole or two metals at the two opposite poles of the battery, metals being obtained in a pure elementary state by electrolysis.

[*No Drawings.*]

A.D. 1881, March 16.—No. 1137.

ENGEL, Friedrich Hermann Felix. — (*A communication from the New York Hamburger Gummiwaaren Compagnie.*)— Making sheets and plates of tin, zinc, and lead, and alloys thereof.

The metal or alloy, while molten, is brought on to or between a pair of revolving iron or steel rollers, preferably placed horizontally side by side in a framework. The bearings of one or both rollers are adjustable and the rollers are geared together like those of a rolling-mill. The diameter of the rollers and speed of revolution vary with the melting-point and hardness of the metal treated. If they are of sufficient diameter and are cooled off by water or by leading currents of air through the interior, sheets of metal of any desired thickness may be produced by directly rolling the same out of the molten metal. To produce plates, the rollers must be first placed nearly close together so as to produce sheet metal, and the distance between them be gradually increased during the rolling till it corresponds to the required thickness of plate, whereupon the process of rolling can be carried on in continual action.

[*No Drawings.*]

A.D. 1881, March 16.—No. 1155.

PAYNE, SAMUEL JONES.—Manufacture of fire-bricks, retorts, crucibles, and other goods to resist intense heat.

Clay, graphite, millstone grit, calcined flints, sandstone, and sands, burnt or unburnt, and ground fine if required, may be used. Very small proportions, if any, of chalk or Farnham stone are permissible. To one or more of the above materials, Portland cement or hydraulic lime is added, and, after intimate mixing, silicate of soda or of potash in solution is added. The materials are kneaded or pugged for thorough mixture. Suitable proportions are 7 lbs. of sand, 1 lb. of Portland cement, and ½ pint of silicate of soda (specific gravity about 1200). The compound is moulded into the desired shapes, and the articles are dried and hardened. They are then sometimes immersed in a weak preparation of silicate of soda or similar alkali, or in a solution of carbonate of magnesia. The final drying may be by heating in chambers to a temperature of 300 or 400 degrees. The above described compound, after kneading or pugging, may be also used for furnace linings.

[*No Drawings.*]

A.D. 1881, March 19.—No. 1218.

VON NAWROCKI, GERARD WENZESLAUS.—(*A communication from Moses Heimann*).—(*Provisional protection only*).—Perforating paper.

An alloy consisting of four parts of tin to one of antimony is indicated for use in the manufacture of rollers for pressing and perforating paper.

[*No Drawings.*]

A.D. 1881 March 21.—No. 1227.

DAVIES, EDWARD.—Cleaning and separating seeds, ores, and like granular material.

The cleaning and separating apparatus is driven by a motor wheel, consisting of a wheel with buckets so arranged as to receive the granular material at a high level and deliver it on to the apparatus at a low level, the power obtained by the weight

and descent of the material driving or assisting to drive the apparatus. Sometimes two or more motors actuated by the material may drive one set of apparatus, or two or more sets of motors and apparatus may operate upon the same stream of material in its course through the machine. Machines for cleaning and separating grain are described. The grain falls on to a bucket or other wheel, causes it to turn, and passes from near its bottom on to a series of inclined sieves fixed in frames which, if desired, can be shaken by tappets or other mechanism from the wheel. At certain distances below where the grain is delivered on to the sieves, there are placed brushes or other circular scrubbers, washers, or polishing rotary apparatus. The brushes are fitted with a semi-cylindrical casing, and the grain passes laterally between the brushes and the casing in a broad stream, almost every particle being cleaned. The brushes are driven from the axis of the main wheel by belt pulleys or otherwise. Below the sieves, a current of air produced by a fan, driven likewise or from a brush spindle, may impinge on the descending stream to carry off light particles. The grain may come in contact with a second motor wheel near the bottom of the machine.

For separating small ores, very different details are used with the motor wheel. For some ores, circular or cylindrical revolving riddles are better than ordinary sieves, and can be used with or without other beaters or cleaners. If the weight of the ore be insufficient, auxiliary power may be applied to the wheel ; or the latter can be dispensed with and the apparatus be driven by a belt from any convenient shafting.

[*Drawing.*]

A.D. 1881, March 21.—No. 1244.

LEWIS, Richard, and LEWIS, John.—Coating metal plates.

The apparatus consists of a tin pot and a grease pot, between which is placed a second grease pot, by passing through which the plates are cooled somewhat before entering the final grease pot.

The plates are delivered into the flux box and pass into a flat shallow metal bath, provided with rollers and fixed guides ; they are carried forward and are directed by guides into the

grease pot, which is also provided with rollers and guides. As the plates pass through the grease pot, superfluous metal drains off into pockets beneath each pair of rolls. The plates are then conducted by guides on to a cradle in the second grease pot; the cradle is then raised so that the plate is seized by finishing-rolls upon which a stream of the coating-metal is delivered. The rollers are all driven at the same speed by gearing. In place of the cradle the rollers may be arranged so that the plate leaves the first grease pot in an upward direction and is delivered at once to the finishing-rolls.'

[*Drawing.*]

A.D. 1881, March 22.—No. 1271.

ROSSER, DAVID, and ROSSER WILLIAM.—(*Provisional protection only*).—Pickling and swilling plates.

The pickling and swilling vats are placed side by side, each containing a cradle for the plates. Above the vats are placed a pair of rails with an undulating upper surface, on which run rollers, to the spindles of which the cradles are hung. The rollers are united in a framework which is attached by a connecting-rod to the crank of an engine so that a reciprocating motion is imparted to it, whilst at the same time the undulations of the rails produce an up-and-down motion. The cradles can easily be lifted from the framework and transferred from one vat to the other.

[*No Drawings.*]

A.D. 1881, March 23.—No. 1297.

WELCH, WILLIAM.—Coating metals.

The surface is covered with a cement composed of comminuted limestone, earths, metallic oxides, and minerals mixed with oils, resinous bodies, tars, pitch, bitumen, and asphalts Upon the cement is placed a coating of granulated cork or fibrous matting. The layers are repeated alternately as required, and the surface furnished with finely-dusted cork, metal, or stone.

[*No Drawings*].

A.D. 1881, March 24.—No. 1323.

LAKE, William Robert.—(*A communication from Léon Létrange*).—Alloys for cartridge cases etc.

To obviate the defects (including liability to cause deterioration of gunpowder, and insufficient power of resistance for repeated use) of cartridge cases made of brass, there may be employed a malleable bronze, consisting of copper and tin or nickel, or both. Gun metal, containing from 8 to 12 p.c. of tin, has most of the requisite properties. A previously prepared alloy of copper and tin in equal proportions may be added to the necessary quantity of molten copper. Phosphuret of copper is also introduced into the copper, into the said prepared alloy, or into the final alloy, and incorporated by energetic stirring, the proportion being such as is requisite for deoxidation and such that only from one to three ten-thousandths thereof will remain. The phosphorus frees the alloy from any oxygen present, imparts to it limpidity or clearness, and prevents eliquation of the tin during cooling, a homogeneous and malleable, but very hard and tenacious, alloy being obtainable. An alloy of copper and nickel, with or without tin, may be likewise produced. The proportions of the metals may be varied to render the alloy more malleable for manufacture, or more capable of resisting oxidation and the effects of firing. Iron, manganese, tungsten, or other metal may be introduced into the alloy to impart hardness or tenacity.

[*No Drawings.*]

A.D. 1881, March 26.—No. 1350.

WILLIAMS, John, and MORRIS, George Lockwood.—Pickling and swilling plates for coating with tin or other metals.

A central vertical support carries a circular horizontal plane, on which rests a rotatable framing provided with radiating arms, each of which carries two pulleys. Centrally in the pillar is a single-acting steam cylinder with a connecting-rod, to the top of which are attached series of chains passing over the pulleys of each arm, and carrying light metallic cradles. The weight of the cradles is balanced by weights upon the connecting-rod. Tanks are arranged under two of the arms, and under the third is a table for charging and discharging the cradles. The tanks

are provided with helical guides, by which a twisting motion is imparted to the cages as they pass in and out of the tanks. While one cage is on the table being charged with plates, the other two are in the pickling and swilling tanks respectively. By admitting steam or other motive agent above the piston the three cages are simultaneously raised. When the cages are clear of the tanks the arms are turned through one third of a revolution, and the cages are again lowered.

[*Drawing.*]

A.D. 1881, March 29.—No. 1386.

CRELLIN, Horatio Nelson, junior, and ROLFE, Charles Spencer.—Furnaces etc.

A drawing of a reverberatory metallurgical furnace is given to show the application of the invention thereto. Steam may be led from a boiler through a pipe to an arrangement of nozzles or jets, in combination with pipes, jets, or nozzles communicating with a reservoir of paraffin oil or other liquid fuel, so that the steam will act after the manner of perfume-diffusers or injectors. The steam passing to the nozzles may be highly superheated and liquids having very high flashing points be then used. The nozzles may be placed near a burner or lamp, which helps to heat the boiler and ignites the jets of liquid fuel, the latter being by the aid of the steam finely divided and heated to the flashing point. Small quantities of water may be injected (by an automatic arrangement described) into the boiler, or sometimes the latter may be partly filled with water. The said drawing shows a boiler in the roof of the furnace with a pipe leading therefrom to the fire-chamber, which appears to be provided with an arrangement for burning the liquid fuel. An intense and pure heat is obtainable. Sometimes the use of steam may be partly or wholly dispensed with.

[*Drawings.*]

A.D. 1881, September 30.—No. 1399.

MATTHEWS, Isaac. — Coating metallic plates with tin or other metals.

A rectangular or other shaped vessel is employed for containing the molten metal to be employed as the coating. This

vessel is enlarged at one end for the purpose of receiving the plates to be coated, whilst at the other end there is provided an arrangement for receiving the roll box. The plates are fed into the bath of molten coating metal at its enlarged end, which is capable of containing any desired number of plates at the same time, the said plates being moved forward consecutively along the bath by suitable machinery, such, for example, as endless travellers. At the neck or end of the enlargement of the vessel, there is provided a pair of wire brushes or a pair of steel plates so slit as to form a comb, between which brushes or comb plates the metal plates to be coated are partially passed and received on the further side by machinery which passes on the plates to the further end of the pot or bath, and underneath the roll box.

The lower end of this roll box is caused to dip a short distance, say about two and a half inches, into the molten metal, and contains two or more pairs of rotary delivery rolls. Underneath these rolls there is provided a shoot or guide enclosed all round and so placed that its upper edge shall stand above, and its lower edge below the surface of the molten tin metal. The primary object of the said shoot is to keep back and prevent the surface scruff from adhering to the plates as they are passed upwards through it to the grip of the lower pair of rolls which serves to pass them to the remaining rolls. Under the top or finishing rolls there is placed a pair of comb plates, between the edges of which the coated plates pass, the pressure of the comb plates being adjusted and regulated by a thumb screw, thereby regulating the quantity of coating metal on the plates, and remedying defects in the coating.

[*Drawing*].

A.D. 1881, March 30.—No. 1406.

LYSAGHT, John.—Coating sheets or plates of metal.

The plate to be coated is delivered between the rollers, and is carried forward between flat metal plates, the lower of which is heated by a furnace ; thence it is directed by guides to rollers, and by them passed into the bath containing the coating-metal. The plates are directed through the bath by guides and delivered to a pair of tongs, attached to a rope, which is led

round a drum having the same diameter as the rollers supplying the plates to the machine. The plate is thus withdrawn at the same rate as it is passed through the bath.

[*Drawings.*]

A.D. 1881, April 6.—No. 1503.

DUFRENÉ, HECTOR AUGUSTE.—Furnaces.

To separate the metal from contact with the fuel, a cupola furnace may be heated by gas and it may be provided with a vault or arch, which retains the solid iron, while the liquid iron collects at the bottom. "The flame enters at the upper "portion of the crucible, passes across the arch, and rises "through the column of solid iron and heats it." The arch is supported by a vertical wall, which has openings in its lower part "for the mixture of the liquid iron," and in its upper "for "the proper distribution of the pressure of the gases." In a cupola with an "exterior crucible for collecting the liquid iron," the flame "enters into the upper part of the crucible and passes "through the pile of iron."

The gas may be produced in a separate sheet-iron generator, formed of three movable parts, the middle part requiring to be renewed less frequently. "The blast arriving under the grate is "divided into two parts ;" one serves for burning the fuel, and the other "passes around the generator, becomes heated, and "passes above to assist in the combustion of the gases." The combustion "continues in the upper part of the crucible."

Again, liquid fuel may be converted for use into gases to obtain a very high temperature or a rapid production, or to avoid altering the quality of the iron treated. Air passes through a channel in front of the liquid fuel, which it projects on to a plate to increase its division : there is also a distributor. "The chamber is sufficiently large to allow the combustion to "be nearly complete when the flame comes in contact with the "solid iron."

Sometimes solid fuel may be burnt on an ordinary grate near the cupola, which the gases from the combustion afterwards enter. The fuel should be thick enough to prevent cold air passing, without producing much carbonic oxide.

[*Drawings.*]

A.D. 1881, April 12.—No. 1584.

HARGREAVES, JOHN, and ROBINSON, THOMAS.—Treating antimony ores etc.

The ore, after being (when needful) at least sufficiently pulverized to pass through a sieve of two millimeters in opening, is treated with hydrochloric acid of not less than 1·06 specific gravity. The temperature is gradually raised by internal or external heating of the vessel employed, and finely-divided ore is added till as much antimony as possible has been dissolved by the acid. A partial vacuum should be maintained in the dissolving-vessel, so that the sulphuretted hydrogen generated from sulphide of antimony may pass freely away without annoying the workmen ; it is passed through cooling-pipes, scrubbers, or condensers, wherein any accompanying chloride of antimony and hydrochloric acid are recovered, and thence through chambers containing oxide of iron to decompose the gas and absorb the sulphur, or directly into the sulphurous acid flue leading to vitriol chambers or to the converting cylinders of the Hargreaves and Robinson direct-action sulphate-of-soda plant. If the ores contain much of such gangue as will neutralize the hydrochloric acid, they should be treated in vessels having openings for removing the undissolved gangue at intervals, by which means the basic materials in the ores other than antimony are used to neutralize the excess of acid in the solution.

The solution of chloride of antimony, after settling, is run into vats, and any excess of acid is partly neutralized, as by lime or magnesia, to reduce the quantity of iron or zinc required for precipitating the antimony and to diminish the evolution of antimoniuretted hydrogen during precipitation. The neutralized solution, after settling, is run into tanks and maintained at a suitable temperature by internal or external heating, and antimony is precipitated by adding metallic iron or zinc to the solution. The precipitate is preferably washed with a solution of chloride of antimony, hydrochloric acid, and water to remove any metallic iron, zinc, lead, or other objectionable impurities ; and it is drained, pressed, dried, and fused with alkali and carbon in a crucible.

Strong and suitable hydrochloric acid may be obtained as a bye-product in making sulphate of soda, and arsenic may be precipitated from it by sulphide of antimony before use. To

recover the hydrochloric acid, the chloride of iron solution formed in the precipitating operation is evaporated and then roasted in a muffle furnace in presence of air and water vapour, the chlorine combined with the iron being liberated as hydrochloric acid (as well as any free acid) and used again.

Ores sufficiently free from arsenic may be thus treated :—The sulphuretted hydrogen evolved while the ores are being dissolved is oxidized or acted upon by binoxide of manganese or perchloride of iron added to the solution, or by air blown therethrough when iron is present. The sulphur is precipitated and the chloride of antimony treated as above described.

The dissolving-vessels, which may be of stone or of or lined with antimony or an alloy thereof, have a loosely-fitting cover or cover with a safety-valve or equivalent. A fixed cover with a charging-opening to be closed by a cover or valve, which has a luting of powdered ore and will be lifted by suddenly developed pressure, may be used. A pipe for the sulphuretted hydrogen leads from the cover or side of the vessel. The stone, wooden, or other precipitating-tanks may have loose cowls or hoods for carrying off antimoniuretted hydrogen.

[*No Drawings.*]

A.D. 1881, April 12.—No. 1605.

CLARK, ALEXANDER MELVILLE.—(*A communication from Léon Louis Charles Krafft and John Edward Schischkar.*)—Treating ores, and extracting the oxides and carbonates of zinc and copper.

Ores (such as are abundant at mines but too poor to pay for transport) after being reduced to powder may be treated in closed vessels with the liquid ammonia of commerce preferably diluted with its own weight of water, whereby the carbonates and oxides of copper and zinc are dissolved, leaving the gangue of the ore. The ore may remain in contact with the ammoniacal solution for 48 hours or preferably be agitated with it for 4 or 6 hours, or the solution may be filtered through the ore. The solution, after settling, is transferred to an iron vessel and heated (as by direct heat or introducing steam) to distil off the ammonia, which is passed through a condensing-worm and recovered for use again ; or the distilled ammonia may be passed

into a closed vessel containing ore mixed with water, in which the ammonia will be condensed. The ore is thus directly attacked by the aid of the agitation produced by the condensation, the operation being shortened. It is also rendered continuous, since the ammoniacal solution of zinc or copper thus obtained, when treated in the same way, will give up its ammonia to be again condensed in the water wetting a fresh batch of ore, and so on, according to the number of closed vessels employed. The magma, left by distilling off the ammonia, is dried and then calcined to expel carbonic acid so as to obtain pure oxide of zinc or copper. Again, pure zinc white can be obtained by placing in the ammoniacal solution, containing the carbonate of zinc, sheets of metallic zinc to which the foreign metals, such as cadmium and copper, soluble in ammoniacal salts, adhere. The gangue, which might contain blende, galena, cinnabar, or other unattacked metallic compounds, and which is now heated to disengage and collect any remaining ammonia, is already enriched by the previous treatment, and may be washed to separate the earthy and other matters from the metallic part and thereby produce a rich ore. Carbonate of ammonia in solution may replace the liquid ammonia.

[*No Drawings.*]

A.D. 1881, April 13.—No. 1630.

JOHNSON, JOHN HENRY.—(*A communication from Nicolas Emile Reynier.*)—(*Provisional protection only.*)—Treating ores and compounds to separate metals, and to produce electricity.

The principles involved in the electro-chemical treatment include the following:—Solutions of caustic soda and potash oxidize and dissolve metals, particularly zinc and lead, electricity being produced. Certain metallic solutions can act as a depolarizing agent in a voltaic pair or element with two liquids, the metals being set free. Ordinary saline solutions of metals can be replaced by crude solutions obtained by exposing the ores (roasted if needful) to the action of acids in voltaic pairs when one of the liquids employed is of an alkaline sodic or potassic character. A rich or enriched ore of zinc or lead able to act as a conductor may replace the zinc or lead in voltaic pairs where the said alkaline liquids are employed; and scrap waste or

parings of lead or zinc may replace the lead or zinc plates. A system of multiple porous and communicating vessels, obtained by radiating folds of sheets of paper, woven fabric, felt, skin, membranes, or other pliable septa, can reduce the resistance of the pairs and augment their action.

The results include the production of useful or easily reduced oxides from ores of zinc and lead; the liberation of metals, especially copper, nickel, cobalt, lead, silver, mercury, and gold, from their saline solutions obtained by the action of acids, chloride of sodium, and the like on their ores; and the production of electricity.

A voltaic pair with two liquids is employed, one being a solution of caustic soda or potash, wherein is immersed an anode of zinc or lead, or rich fragments of galena or of calamine or other ore of zinc. A partly immersed plate of lead or zinc rests on the fragments. The other liquid may be a cupreous solution (malachite may be dissolved in sulphuric acid after grinding). Metallic copper collects in the copper compartment and chiefly oxide of lead or zinc in the soda compartment, this oxide being convertible into metallic lead or zinc by treatment with carbon at a red heat, after extracting it from the soda. The other metals, besides the lead and zinc contained in the ore, particularly the silver, not being dissolved by the soda remain in and are extracted from the battery. The oxide of lead or zinc may be precipitated or eliminated by carbonic acid, sulphurretted hydrogen, or chlorine, in the state of carbonate, sulphide, or chloride of the metal, and the sodic solution is regenerated: carbonate of soda or potash will both carbonate the metal and regenerate the electrolyte. The sulphate of soda (or potash), formed by the voltaic action, is collected by crystallization. The permeable partitions, which separate the two electrolytes, must resist the action of the liquids employed; hence the usual porous vessels are excluded. Moreover these vessels of quasiprismatic form have inadequate superficial area in proportion to their volume. To increase and multiply the action of the septa or partitions, the multiple vessels are employed. Modes of forming double, quadruple, and various other multiple porous vessels, without joints and capable of interlocking in pairs, by folding a square sheet of the septum, for example, in different degrees and ways are described.

[*No Drawings.*]

A.D. 1881, April 20.—No. 1720.

CLARK, Alexander Melville.—(*A communication from Jean Baptiste Marie Prosper Closson.*)—Refractory magnesian products.

Reference is made to the prior Specifications No. 4253, A.D. 1879, and No. 701, A.D. 1881, the former of which relates to manufacturing magnesia by means of calcined dolomite and various chlorides, including waste residues. From the chloride of magnesium produced at first with chloride of calcium, there may be precipitated the magnesia by treating with more dolomite, or the separation of the magnesia may be otherwise effected.

Magnesia obtained by means of the present invention may be used for manufacturing refractory products, after the removal of any remaining carbonate of lime, and for this latter purpose processes to which the prior Specifications relate may be employed.

Dolomites and magnesian limestones are to be calcined at such a temperature (500° to 600° C.) that the carbonate of magnesia is converted into magnesia, while the carbonate of lime remains undecomposed. By pulverizing before or after calcination, and separating and sorting by means of a blast or by washing, the products may be enriched in magnesia even to the extent of obtaining magnesia by itself.

[*No Drawings.*]

A.D. 1881, April 23.—No. 1768.

WEDEKIND, Hermann. — (*A communication from Hans Hauenschild.*)—(*Provisional protection only.*)— Refractory magnesian products.

Magnesia may be thus obtained so dense as to be well adapted for making basic bricks :—Powdered magnesian limestone or dolomite or lime containing siliciferous carbonate of magnesia or the paste of the hydrate (*i.e.* the stone burned and slaked) is placed in " wood tar water or raw vegetable acid," stirring and gently warming, whereby there are formed a soluble combination with lime and an insoluble combination with magnesia, and the latter is distilled.

Also the said powder or paste may be placed in a solution of chloride of magnesium heated to 120° Cent. at least, until

saturated, introducing superheated steam and stirring; the magnesia will be thus precipitated as carbonate or hydrate.

[*No Drawings.*]

A.D. 1881, April 26.—No. 1808.

LAKE, William Robert.—(*A communication from Joshua W. Houchin and Joshua R. Houchin.*)—Puddling and other furnaces.

In the escape flue of a puddling-furnace, between the puddling-trough and the chimney, there is interposed an arched flue or air-heating chamber in the shape of an inverted U. Air from a blowing-engine or fan is conducted through a series of curved pipes arranged in the said flue so that the air becomes heated, suitable connecting-pipes etc. being provided for conveying this blast to the outside of the front end wall of the furnace. Between this wall and the bridge wall there is a space or kindling-box, on the floor of which a small fire may be made. The bridge is so curved towards the front wall that the kindling-box is much narrower above than below. Atomizing-nozzles are inserted in the front wall, and convey the heated blast into the widest part of the kindling-box a little above the floor. Pipes for the supply of hydrocarbon liquids lead from a reservoir of oil, and terminate within (and nearest to the upper edge of) the ends of the atomizing-nozzles, so that the oil falling from the pipes is intercepted and blown into atoms by the air jets of these nozzles. Valves regulate the supply of oil and air to produce proper vaporization and partial ignition. The vapours ascend through the narrow part of the kindling-box and in passing over the bridge encounter a sheet jet of air, likewise entering through the front wall by means of a nozzle, which extends across the full inside width of the furnace, and directs the sheet jet towards the body of the furnace. Thus the vapours become thoroughly ignited, and the intensity of the heat increases as they reach the puddling-trough, while the temperature in the kindling-box is comparatively low, which prevents injury to the nozzles. The upper nozzle for producing a sheet of blast consists of a cast-iron box with a rectangular opening, this box having within it a hinged or pivoted damper or gate valve, actuated by external gearing, for adjusting the thickness of the discharge opening without

altering its width. Complete combustion is effected, and the heat from the furnace is utilized in heating the blast as it traverses the curved pipes.

[*Drawings.*]

A.D. 1881, April 28.—No. 1836.

GLASER, Friedrich Carl.—(*A communication from Carl Haegele.*)—Coating metals.

Relates to the manufacture of copper plated sheet iron and other plates and wires for making hardware. To prepare copper plated sheets, a copper plate and an iron plate are heated to whiteness with their carefully cleaned faces placed together without flux in a furnace preferably formed as a segmental retort, and the two are welded together and brought to the desired thickness by passage between rolls. Coppered wire for making hardware may be prepared by similarly heating an iron rod surrounded by sheet copper, and passing it through wire-rolling and finally through wire-drawing apparatus.

[*No Drawings.*]

A.D. 1881, April 28.—No. 1847.

HUGHES, Walter Watson.—Extracting copper from its ores.

Large furnaces, like ordinary reverberatory copper ore smelting furnaces, but with deep beds, are employed. Inclined tuyères, for blowing air, or steam and air together or separately, into the bath of molten matter in the bed, are so set as also to produce rapid circulation of the bath ; they are adjustable up and down, so that they may dip more or less into the bath and be drawn up to avoid clogging. Several furnaces are used. In desulphurating furnaces the crude ore is melted with flux and the sulphur is partly burnt off, or melting may take place in one furnace and the fused materials be run into the others. The bath prepared in each furnace is highly heated by the blast, and a charge (it may be $1\frac{1}{2}$ or 2 tons) of small ore is gradually dropped into the bath and mixed in by the said circulation and by rabbling. When this charge is melted and the bath again fully heated, another charge is likewise added, and

so on till the furnace is full, the slags being removed at intervals. Each desulphurating furnace is then half emptied into an accumulating furnace or roaster on a lower level, where sulphur is further eliminated by heat and blast, metal of about 50 p. c. being brought to about 75 p. c. and at this standard being run into, say, an ordinary refining-furnace at a still lower level and finished as usual. The half-emptied desulphurating furnaces are charged with fresh ore, the process being continuous.

A reducing-furnace might be employed, made considerably longer than broad, with fireplaces in its sides and ends, and with a double bottom of firebricks in grating fashion whereon the ore is placed, some of the fires passing over the ore and some beneath the grating bottom. The melted metal would run from this into a desulphurating furnace.

[*No Drawings.*]

A.D. 1881, April 29.—No. 1865.

CROSLAND, Edward.—Calcining-kilns.

Ores may be continuously calcined in a kiln, which widens out from the bottom to a certain height, and then narrows inward, presenting at each side a sloping overhanging shoulder ; the latter contains inlet openings for combustible gas from a gas flue behind. From the shoulder the kiln still narrows to the top, where there are one or more covered feeding-holes. At some distance below the latter, lateral openings on each side lead to a chimney flue. A wedge-shaped structure extends some distance up within the kiln, and has on each side a slope like that of the lower part of the kiln wall. In the narrow portions at the bottom of the kiln there are lateral openings for admitting air and removing the calcined ore. The wedge-shaped structure may have in its upper part an air cavity with openings into the body of the kiln. Large kilns may contain several such structures ; and in a round or square kiln the structure may be conical or pyramidal. The kiln being charged and kindled, gas enters through the overhanging shoulder at one side of the kiln and is burnt by air, which in ascending from the bottom becomes highly heated in passing through the calcined ore. The flame and products of combustion strike obliquely upwards and across the body of ore above to the apertures leading to the

chimney flue on the opposite side of the kiln, which is then open. At intervals the one gas flue and the opposite chimney flue are closed by dampers, the other gas and chimney flues being opened. Thus the flame etc. will alternately cross the charge from right to left and from left to right. The ore is dried, heated, and calcined as it descends to the zone of combustion, below which it becomes cooled by the ascending air. Gas from a producer may be replaced by hydrocarbon vapour or spray, the last-named being blown in by hot air or superheated steam by the aid of nozzles. Sight-holes allow the heat at different parts to be ascertained. Again, the kiln might have a central chimney to be used also as the feeding-aperture.

[*Drawing.*]

A.D. 1881, April 30.—No. 1874.

RAMSDEN, William.—(*Provisional protection only.*)—Annealing.

To anneal or soften cast iron, the inventor "places the "articles in an iron retort, along with a mixture of red ore and "oxide of manganese or nitrate of potash or other material "which gives off oxygen gas at a low temperature." A low red heat, kept up for several hours, "loosens or disengages the "carbon in the iron ; and this carbon combines with the oxygen "given off by the manganese or other material, so as to form "carbonic oxide, which is carried off through" an opening in the retort.

The process is also applicable to steel castings.

[*No Drawings.*]

A.D. 1881, May 2.—No. 1893.

ABEL, Charles Denton.—(*A communication from Dr. Karl Schnabel.*)—Treating furnace gases etc.

Sulphurous acid fumes contained in such gases are to be absorbed and rendered innocuous by being converted into sulphite of zinc by means of zinc oxide or carbonates or sulphates of zinc. The zinc oxide may be rendered porous by admixture with basic sulphate of zinc. The substances are employed in pieces or powder, moistened with water, and are charged into

absorbing chambers, boxes, or towers, which may be so connected that fresh gases first come in contact with the most exhausted absorbing-substances and *vice versâ.* The substances may be spread in layers on perforated trays or hurdles, through which the gases or fumes to be purified are drawn as by chimneys or fans. The sulphurous acid is energetically absorbed, combining with the zinc oxide to form sulphite of zinc with about 25 p. c. of water. The sulphite may be heated to redness in a muffle or oven to regenerate the oxide for use again, concentrated sulphurous acid being evolved, to be used in making sulphuric acid and other products. Again, the absorbing-medium in powder may be beaten into clouds inside a chamber, through which the gases are passed ; an intimate contact is thus ensured. Any sulphuric acid in the gases is also absorbed forming solid sulphate of zinc, which may be utilized.

[*No Drawings.*]

A.D. 1881, May 2.—No. 1894.

ABEL, Charles Denton.—(*A communication from Eugen Langen.*)—Calcining ores etc.

Apparatus for the production of combustible gas is described, the gas producer being applicable to the calcining of ores etc., or to carbonizing substances, for which purposes the necessary proportion of carbonaceous matter would be mixed with the substances to be operated on when charged into the upper end of the retort.

The upper part of the gas producer is formed with a space, into which the carbonaceous material is charged, and which is surrounded by an annular space, whereinto the gases produced by distillation escape through holes in the lower part of the first-mentioned space, and whence they are withdrawn by an exhauster for use elsewhere. Below this space is a shaft or retort, highly heated externally, wherein the volatile constituents from the carbonaceous material are distilled as it gradually descends towards a lower chamber, in which the non-volatile constituents are converted into combustible gas by imperfect combustion with air admitted below. This lower chamber dips into a tank of water, and has at its middle a fire-grate supplied with air by a pipe. Such material as the construction of the grate may allow to descend into the tank is

thence withdrawn at intervals. The combustible gas generated in the lower chamber is led from the top of it through flues into an annular chamber surrounding the retort, where it is burnt by highly-heated air to intensely heat the upper part of the retort. The resulting hot gaseous products of combustion, on their way to a chimney, are led into a regenerator to heat the incoming air. The regenerator is a chamber, divided by a sloping partition of ribbed metal plates into two passages—a shallow passage for the air—and, for the hot products, a passage gradually narrowing from the inlet towards the exit end, to prevent overheating of the metal plates at first, and secure more intimate contact therewith as the products cool and become contracted in volume. Above the said lower chamber, steam or other suitable fluid is led into the retort through pipes to be decomposed and form gases, which mix with those produced by distillation. A slanting supply pipe leads from the bottom of a tank upwards through the heated walls to a higher level than the tank, so that, according to the level of the water maintained in the tank, a greater or less volume of it will be subjected to heat inside the pipe and a corresponding quantity of steam introduced into the retort. The exhauster action and the chimney draught may be so adjusted that none of the distilled gas passes to the chimney and little or none of the gas generated in the lower chamber mingles with the gas distilled above ; but, in calcining, the whole of the carbonaceous gases evolved may be passed into the annular chamber around the retort and there burnt.

[*Drawing.*]

A.D. 1881, May 2.—No. 1897.

BARLOW, Walter Alfred.—Production and use of gases.

For heating and metallurgical purposes, there may be used oxygen and hydrogen gases, which are to be obtained by the electrolytic decomposition of water by means of powerful currents generated by dynamo-electric machines in accordance with the invention, the gases being thus commercially available and as a new manufacture. The decomposing-tank is provided with two hoods, into which the oxygen and hydrogen respectively rise to be carried off by pipes to separate reservoirs. If the tank has only one hood, the gases will be mixed and not fit for storage in quantity, but useful for gas engines or furnaces

where the consumption immediately follows the production. To prevent back pressure or danger of extended explosion, the supply pipes may have a succession of gauze covers or diaphragms. Gauze wire diaphragms, with a mass of fine crushed wire between them, may be provided at the adjacent flanged ends of pipes in connection with a double-flanged piece and two ring pieces with grooves turned in their faces to receive packing, a drawing showing the parts as held together by bolts and nuts.

For metallurgical purposes etc., the gases will be used either alone or in combination from nozzles or pipes capable of regulating the supply of one or other gas, or the two in mixture at the outlet, but with successive diaphragms if employed together; the oxygen will thus form a powerful auxiliary in some cases of smelting in addition to the ordinary carbonaceous fuel for oxidizing flames and intensifying the heat, and the hydrogen will be employed as reducing-agent, or the two gases be used for simultaneous combustion in a gas or oxy-hydrogen furnace.

[*Drawing.*]

A.D. 1881, May 3.—No. 1916.

LAKE, William Robert.—(*A communication from Frederick William Wiesebrock.*)—Desulphurizing ores.

A series of retorts or chambers may be arranged one below and in advance of the other, and communicating with each other by a passage or tube, each retort having at the open end opposite the passage a hydrocarbon blast injector. At the upper end of the said series is an ore-hopper, while a fume-condenser communicates with the lower end. Finely-powdered ore falls from the hopper and a feed pipe into the first retort and meets a blast or flame and air; the air and ore become highly heated, and the ore is carried through the retort into a receiver and becomes oxidized, the receiver being large enough for the blast to expend its power therein so that the ore may settle. The funnel-shaped bottom of the receiver forms a hopper in connection with another feed pipe, whence the ore is carried into and through the second and succeeding similar retorts. At length the ore is passed through an upright flue into a retort, set in a furnace (which also serves to heat the air blast pipe, the other retorts, and the receivers), and containing a screw conveyer of less diameter than this retort so that air may freely pass

therethrough to aid in the final oxidation of the ore, which may be thoroughly desulphurized whatever the percentage of sulphur. The feed pipes of the other retorts are fitted with screw conveyers actuated by bevel gearing to effect a regulated delivery of the ore to the respective retorts. The receivers communicate with a flue, which is inclined to prevent ore from collecting therein, and leads to the condenser. The latter has a perforated or "foraminous" partition near its upper end, so that a shower of water spray may enter the condenser and arrest fine particles of ore, which can be treated again, if needful, almost all the metal being saved. To chloridize the ores, mechanical means for introducing needful ingredients and any suitable menstruum may be provided.

The apparatus in connection with the blow-pipe injectors, for providing blast-flames of carburetted and atmospheric air, include a blower, blast pipes (one being an air-heating pipe), nozzles (into which blast pipes project, to form the injectors), oil tanks, pipes, a pump, controlling stop-cocks, and an intermediate air-carburetting tank. The latter has perforated pipes to distribute a spray of oil between partitions, which form a circuitous channel in connection with a blast pipe at one end and with pipes leading to the said nozzles at the other. Oil may be also fed to the nozzles so as to flow directly into the current of heated air in the blast pipe to increase the flame. The current of blast-flame carries with it into the retorts an additional supply of air, which enters around the blast-flame of the injector and, becoming heated in the retort, aids in oxidizing the ore. The retorts are long enough for the ore to be suspended in the blast flame until sufficiently heated to absorb oxygen.

[*Drawings.*]

A.D. 1881, May 5.—No. 1961.

HIGGS, PAGET.—Alloys.

In connection with magneto-electric machines described, the inventor makes conducting wire of an alloy composed of steel (not iron) and aluminium, in proportions of at least 85 parts of steel to 15 of aluminium. About 1 per cent. of silver may be sometimes added. Such an alloy easily draws into wire, and has notable strength and conducting powers.

[*Drawings.*]

A.D. 1881, May 6.—No. 1974.

LAY, Horatio Nelson, and BULFORD, Harry.—Condensing-chambers for fumes obtained by roasting arsenical pyrites etc.

The ordinary chambers not being durable and, owing to their retention of heat, much of the arsenic being carried out and lost or if retained frequently so burned as to be useless, the inventors form air flues in the transverse walls which divide the chamber into intercommunicating compartments as usual. Each transverse wall contains horizontal flues, open at one end to the atmosphere and connected together at the other end by a vertical flue; the flues nearly surrounding the aperture through which the fumes pass from one compartment to another, so that they may be radially cooled, and thus the heat absorbed from the fumes is rapidly removed from the chamber. To increase the draught of air through the flues, their exit ends may be connected to a chimney. The chamber is covered with a roof of iron, which is protected from the action of rain by a light covering or outer roof of wood, iron, or other material, space being left between the two roofs for the free passage of air and radiation of heat from the inner roof, which may have an internal coating of plaster of Paris to protect it from the action of sulphur in the fumes. The outer walls of the chamber are braced together by iron bars, passed through the air flues in the transverse walls, and secured to plates or bars which bear on the brickwork at the sides of the open ends of these flues. Thus the bars may be kept cool and out of contact with the fumes, and the walls of the chamber may be built thinner than usual, the radiation of heat being facilitated. The flues leading into and from the chamber may also have an iron roof likewise protected, and their walls may contain air flues.

A portion of the chamber might be sometimes formed with iron walls.

[*Drawing.*]

A.D. 1881, May 7.—No. 1995.

LAKE, William Robert.—(*A communication from Philetus Woodworth Gates.*)—Breaking, crushing, or reducing stone, ore, etc.

A cast-iron or other metal frame of tubular or other form

comprises a downwardly-flaring lower or sustaining portion and an upwardly-flaring upper portion; it is united to a base plate, and has a strong skeleton arch-shaped cap at its top. An inclined diaphragm plate (in connection with a discharge chute) crosses the interior of the frame and has a flanged central passage, the frame having openings for the discharge of reduced ore, etc., and for giving access to the machinery. A strong white or chilled metal lining provided for the upper part of the frame may be plain on its inner surface, and be in segments or sections in the form of portions of an inverted truncated cone and supported in position between strong lugs on the frame, this part forms the crushing-concave. A strong cylindrical sustaining-box rests centrally within the arched cap. At the upper end of the crusher shaft is a ball-and-socket joint or fulcrum bearing, *i.e.* a chilled ball on the shaft is fitted within a chilled bearing, which is formed of several segments and has its exterior cylindrical surface fitted within the sustaining-box, a dust guard being placed over it. Opposite the crushing-concave, the crusher shaft carries a chilled metal crusher head of taper form, molten metal being run into horizontal polygonal grooves, formed respectively in the said shaft and head, to form rings and unite the cast-metal head and wrought-metal shaft firmly together. A drawing shows the crusher shaft as contained within the crushing-concave and passing through the central passage in the said diaphragm. There is a loose collar between the crusher head and the flange of the diaphragm. The shaft at its lower or journal end has an eccentric rotating bearing box with a top supporting flange, and the base-plate of the machine has a strong step or cylindrical well partly above and partly below the base plate, the bottom of the shaft resting on an adjustable step block, held in position by a set-screw and nut with a packing to prevent oil leaking from the well. Lubrication of the eccentric bearing beneath its supporting flange, as well as between its interior surface and the journal of the shaft, and its exterior surface and the well (forming an oil chamber) is effected by the aid of an inner circular channel formed in an endless ledge at the upper end of the well (in connection with an oil-retaining flange), various passages, and an indicator pipe. A conical loose collar or guard, which is placed around the shaft and overhangs the top of the well, contains an oil-supply

passage which may be covered by a valve. This collar fits closely enough to an overhanging shoulder on the shaft to prevent dust from descending into the well. The eccentric bearing, which encircles the journal of the shaft, is of bronze or other bearing metal and its supporting flange or plate is of like metal; this flange rests upon the channelled ledge and revolves with the bearing. A toothed or other gear-wheel (to which the said conical collar is attached) is fastened round the upper end of the eccentric bearing; and a driving-shaft, bevel gear-wheel, fast and loose pulleys, and a large balance-wheel are provided for operating the machine, the last-named gear-wheel meshing with the gear-wheel of the said bearing. Thus this bearing is revolved, which causes the crusher shaft to have a powerful gyratory motion, whereby the ore or other substance introduced into the concave will be gradually crushed between it and the crusher head. A pin, weaker than the rest of the mechanism, passes through an arm of a collar keyed on the driving-shaft and enters a hole formed in a strong boss upon the driving-pulley, which is fitted loose upon the shaft and is coupled to the collar by the pin. If the machine becomes clogged, the pin is broken by torsional strain between its supported ends, so that the pulley will revolve without turning the shaft and instantaneous relief is afforded. The pin is kept in position by a set screw and passes quite through the said arm, the broken parts being at once removable. Again, the safety pin and collar may be applied to the bevel-wheel at the inner end of the driving shaft. The gyratory motion produces a breaking or crushing (and not a grinding) action, with but little wear.

To produce the chilled ball bearing for the chilled ball at the top of the crusher shaft, the pattern, employed to produce the impression in the sand contained in a flask and cope, may consist of a cylindrical body portion with hollowed ends, radial wings extending out beyond the body portion, spherical end portions, and a centreing cylindrical stem. The pattern being centred by its stem in the mould, sand is rammed round it till the flask is full; gates are then formed, the cope adjusted on the flask, and sand rammed in to fill it. The resulting mould comprises a cylindrical chamber, narrow radial channels, a conical seat, a concave or partly spherical depression, a cylindrical socket, another depression, and another seat. A

smooth and true hard metal ball, with a stem and centreing sockets, is provided in connection with metallic parting plates, formed with a concave inner edge, and coated or japanned to prevent the casting-metal from sticking to them. These plates, which may be adjusted close to the ball so as to be passed into the flask without touching the sand surrounding the radial channels, are with the ball set down into the mould ; the stem sets into the socket and the plates fit into the radial channels, while the ball stands centrally in the said chamber, a slight radial movement being now given to the plates to set them a little off from the ball. Thus narrow webs will be temporarily formed between the segments of the bearing in casting it, the plates keeping them otherwise separated. The casting produced (which forms the bearing) has its outer and radial parting surfaces unchilled, while its interior surface is chilled by the metal ball. The casting with the webs still uniting its segments is now removed from the mould, and the parting-plates are withdrawn. Then into the hollows at the ends of the casting, as well as into the radial parting splits, there is admitted " babbett " or other metal to form a centreing support, whereupon the cylindrical surface of the casting is turned off true in a lathe. The segments are now broken apart at the webs, the fractured edges being ground off with an emery-wheel, and are next polished on their concave or partly-spherical surface by emery and oil, the tool employed comprising a partly spherical, top, lead head with a steel or iron shank, and being secured in the stock of a drill.

[*Drawings.*]

A.D. 1881, May 10.—No. 2035.

THOMPSON, William Phillips.—(*A communication from John Holland.*)—Treating iridium and certain of its alloys.

The natural dust and grains or scales of iridium or its alloys (as with osmium) may be heated in a crucible as highly as practicable in an ordinary furnace ; a sand crucible will answer. There is then added to the heated metal about one-fourth of its weight of phosphorus, whereupon the metal quickly fuses and should be immediately poured into moulds, which are preferably highly heated to prevent the metal from chilling and setting too quickly. The metal so treated has many uses. To make it

tougher and harder for some purposes, as soon as the poured metal becomes "set," it is returned from the mould to the crucible, adding lime, chalk, or other absorbent of phosphorus, and the crucible is again highly heated; this eliminates the phosphorus and leaves the metal as hard and non-fusible as in its natural state. Thus the metal may be prepared in cubes, blocks, and other forms for use wherever a hard, non-wearing, non-corrosive substance is needed, the production of pen points and journal bearings for watches being described.

[*No Drawings.*]

A.D. 1881, May 10.—No. 2037.

HADDAN, HERBERT JOHN.—(*A communication from Edward H. Potter.*)—(*Provisional protection only.*)—Drying, roasting, &c.

A metal screw conveyer with its enclosing metal casing is located in a brick oven, at the side of which is a fireplace, flues leading therefrom under the oven to an upright flue at the opposite end. There are horizontal flues above the oven, and valves regulate the passage of the gases of combustion from the fireplace to an outlet either directly or through the aforesaid flues. The conveyer has pulleys or gearing, and is worked by a motor. The material treated is conveyed from end to end of the casing by the screw, which also breaks it up and prevents it from caking.

[*No Drawings.*]

A.D. 1881, May 12.—No. 2075.

PATTERSON, JOHN.—Ore stampers.

Reference is made to the prior Specifications No. 872, A.D. 1866, Nos. 16 and 527, A.D. 1871, No. 3485, A.D. 1874 and No. 587, A.D. 1876, which relate to power hammers and ore stampers.

According to the present invention, in place of a quarter or semicircular spring, alternately placed under tension and compression, there is placed a rigid metallic arc, the terminations whereof are forked and hooked outwards to receive the trunnions of two shells or cases containing spiral, volute, or other springs, which rest on the bottom of the cases and act on the hammer through flexible connections. The action is

governed by slide pieces and nuts (held in position by pins or check nuts) to tighten the springs and increase their force. The flexible connections are pivoted beneath the centre of the arc on a pin from which the hammer is suspended. The trunnions ride freely in preferably gun-metal bushings, while the said slide pieces or plates keep dust from the springs, and keep the centre line of the flexible connections parallel to the interior faces of the shell ; a parallel thrust is thus given upon the springs, which are always under compression, but their absolute play is small.

A drawing shows the springs and flexible connections applied to an ore stamper.

[*Drawings.*]

A.D. 1881, May 13.—No. 2102.

LEYSHON, Daniel.—Manufacture of tin and terne plates.

The plates after they have been washed are put into a bath of water, and on removal therefrom are allowed to stand till the water has drained off. They are then placed in a bath of hot palm oil or grease, from which they are transferred to the bath of metal, and are finished as usual.

The Provisional Specification also describes a process in which the water in which the plates are immersed is covered with a layer of oil ; or a solution of carbonate of soda or other alkaline salt is used instead of water, either with or without a layer of oil above it.

[*No Drawings.*]

A.D. 1881, May 18.—No. 2171.

STONE, Robert. — Extracting metals from their ores, and treating other materials.

Reference is made to the prior Specifications No. 2535, A.D. 1879, and No. 2070, A.D. 1880, the former of which relates to the treatment of cement, peat, etc. : it includes kilns and drying floors, and grinding by a pair of corrugated rollers fitting into each other, also between rollers or steel bars and a concave surface or cylinder, revolving motion being communicated to the machine.

Furnaces, to which the prior Specifications relate, may be constructed rectangular, circular, elliptical, or otherwise, and be provided beneath or above with a large space for hot or cold air from a blowing machine to act as a powerful blast. By adding thereto jets of steam and oil, the temperature of the blast and of the furnace may be increased. When smelting ores, the molten metal may flow down inclined slabs of terra-cotta or other refractory material, and air, mixed with annealing substances or oils, may in some cases impinge upon the metal to improve its quality. The bottoms of the furnaces or kilns (which are suited to smelting ores of all kinds and to other purposes) may contain terra-cotta or other bars for sustaining the material under operation.

Ores to be smelted (especially gold ores) may be sometimes finely ground and then mixed with annealing-substances, such as peat or oil. Sometimes grinding is effected by a screw revolving in a conical cylinder, the prior Specifications relating to different modes of grinding.

[*No Drawings.*]

A.D. 1881, May 19.—No. 2182.

HARGREAVES, John, and ROBINSON, Thomas.—Treating ores etc., to obtain antimony and other products.

Reference is made to the inventor's prior Specification No. 1584, A.D. 1881.

The products above referred to include gold, silver, mercury bismuth, copper, lead, cadmium, and tin.

Sulphide of antimony, pure or mixed with other matters, may be dissolved in hydrochloric acid of between 1·11 and 1·20 specific gravity, which acid, before the end of the operation, is brought in contact with an excess of the sulphide of antimony, and the temperature is raised beyond 214° Fahr. and preferably to boiling point. After the excess of sulphide of antimony has settled and the solution has been decanted, fresh or but partly saturated acid acts on the said excess of sulphide, which it wholly or partly dissolves, and an excess of sulphide is again brought in contact with the chloride of antimony solution, these operations being repeated until sufficient undissolved residue (which will contain any sulphide of arsenic present) has accumulated. Then an excess of the acid is added, and the sulphide

of antimony remaining in the residue is dissolved ; the partly-saturated acid is run off for further use, the undissolved residue being drained. A series of vessels may be used. Pumps made of antimony, with antimony or india-rubber valves, are suitable for transferring from place to place the solutions, the acid, or the liquid residues from the precipitation of metallic antimony.

The chloride of antimony solutions (and those obtained from the residues, after the metals therein contained have been made soluble) are subjected to systematic fractional metallic precipitation of the following metals when present :—(1.) Gold, silver, and mercury are precipitated by filtration through, or agitation with, precipitated antimony, their separation being aided when lead is in solution by adding sulphuric acid ; (2) bismuth and copper in like manner by finely divided metallic lead ; (3) preferably after cooling the solution, any remaining lead is precipitated as sulphate by sulphuric acid free from arsenic ; (4) the antimony is precipitated by metallic iron ; and (5) cadmium and tin (which may be first precipitated as sulphides and redissolved in strong acid) are precipitated by metallic zinc.

Gold, mercury, and copper, when present as sulphides, chiefly remain in the residues, as well as metallic bismuth and also silver when largely present. The residues are therefore oxidized, as by binoxide of manganese, nitrate of soda, or perchloride of iron, and dissolved in hydrochloric acid for treatment.

To economize acid in dissolving the antimony, the acid of the strength stated may be subjected to pressure and a higher temperature than the normal boiling point of the solution in vessels of stone, antimony, or its alloy, made to withstand the pressure and action of the chloride of antimony. Heating may be effected by passing steam under pressure or hot oil or solutions with high boiling-points through pipes or shallow boxes in the bottom of the inverted-conical dissolving-vessel, or a double vessel may be used. A stirrer, for agitating the ore during dissolution, may be made of or covered with ebonite, vulcanite, or metallic antimony or an alloy thereof ; or steam, superheated to from 300° to 600° Fahr., may be directed into the solution through a pipe made of antimony, and perforated at the sides for horizontal egress of the steam.

Before precipitating the antimony, the solution thereof is

cooled (as by blowing air through it, or by contact with cooling-surfaces) and allowed to settle for depositing insoluble impurities ; it then flows into the precipitating-tank, and sometimes a small current of air may be passed through it during precipitation ; the best working temperature is about 60° to 80° Fahr. Freedom from impurities being important in the precipitated antimony, the iron employed (cast iron, if sufficiently pure) should have but a small surface per unit of weight, and should be previously freed from scale or oxide by immersion in the acid solution of chloride of iron from the precipitating-tank, whereby also any traces of antimony in this solution are thrown down and may be recovered from the accompanying scale.

To remove impurities, the precipitate of antimony should be thoroughly washed first in the precipitating-tank and then on a felt or other open filter with preferably hot water. Hot solutions of the chlorides of calcium, magnesium, sodium, or potassium, may be used for washing, as well as chloride of antimony, hydrochloric acid, or water. The precipitate is afterwards consolidated into blocks in a filter press under a pressure of, say, from 100 to 150 lbs. per square inch, moisture being extracted and oxidation checked ; and it is dried at a low temperature (never exceeding 300° Fahr.) on or between steam-heated plates or in a chamber traversed by hot gases or air. When a part of the flux is to be added, the cakes are broken up and the two mixed, or the flux is spread over or forced into the cakes. A little carbonaceous matter may be mixed with the precipitate, which, after leaving the filter press and drying, may be highly compressed in a suitable machine to form very dense pieces, less liable to oxidize, and more easily fused.

Fusion may take place in a crucible or pot, which is fed with the precipitate at the top ; while the fused metal may be run out at intervals and as far as possible out of contact with air by a hole near the bottom into ingots, or be directly refined in a subjacent crucible, continuous feeding to the upper crucible and direct running of the refined metal into ingots from the lower being effected. The said crucible is suitably heated, and the antimonious vapours are conveyed away and may be collected. A flux, composed of about 3 parts of chloride of calcium to 1 of common salt, is first fused, and pieces or blocks of the precipitate are added, the flux covering the said pieces to prevent oxidation.

If oxide of antimony be present, a little carbon is also used. A deoxidizing atmosphere, maintained above the metal in the smelting-crucible, may also prevent oxidation. A combined blast furnace and crucible, mounted on trunnions for emptying without removal from the furnace, is mentioned. The flux may be subsequently dissolved to recover any antimony in it.

To recover the hydrochloric acid, the said solution of chloride of iron is evaporated in a vessel or on the bottom of a reverberatory furnace; and the chlorine of the chloride of iron may be also obtained as hydrochloric acid. The acid vapours evolved may be mixed with the comparatively dry hydrochloric acid gas evolved in making sulphate of soda, whereby hydrochloric acid can be condensed strong enough for dissolving sulphide of antimony. The chloride of iron solution may be run into a settling tank, or filtered, to separate the little metallic antimony generally present. A trace of antimony in solution may be thrown down by sulphuretted hydrogen.

The apparatus may comprise tanks, whence acid flows into the dissolving-vessel, resembling a manganese still. A well below receives the antimonious solutions, which can be pumped up into a settling vessel; whence they flow down into precipitating vessels, placed higher than the filter. An asphalted or stone floor is formed to drain away for collection any liquid falling on it.

[*No Drawings.*]

A.D. 1881, May 19.—No. 2184.

CAMPBELL, FREDERICK.—(*Provisional protection only*).—Amalgamation of gold.

Auriferous sand or powdered ore is introduced into a washer tank, where copper-bladed or other stirrers keep revolving. This tank of water has a bed or bottom of quicksilver. Here the sand is thoroughly beaten up and washed; the wet sand, after the washer is well charged, is beaten over the end of the washer into a riffle box, which is fitted with a series of copper troughs arranged step fashion for holding quicksilver, over which the sand passes by gravity. Thence it passes on to precipitating corrugated amalgamated copper trays or tables, fitted with quicksilver troughs, and thence to tables covered with baize. The amalgam is removed at intervals and treated

to recover the gold, the troughs being replenished with quicksilver.

[*No Drawings.*]

A.D. 1881, May 19.—No. 2199.

TRUBSHAW, Ernest, and LEYSHON, George.—(*Provisional protection only.*) — Manufacture of tin and terne plates.

The pot or vessel is divided into two or more compartments, all of which may contain tin or terne metal, or one may contain grease and the rest metal. In the compartment in which the plates are first treated, is a division extending from the top to such distance downwards, so that its lower edge is always below the surface of the metal. On the surface of the metal, on the outer side of the division is a layer of resin and tallow, and on the inner side a layer of tallow and palm oil. On the inner side also is a cradle to raise the plates, and brushes are fixed above it at a convenient height. The other compartment contains tin or terne metal or grease and an arrangement of iron or steel rolls.

The plate is pickled in the usual way, and is put into the outer portion of the first compartment, it is passed under the division, raised by the cradle, passed between the brushes, then into the second compartment, being guided through the rolls therein, and is then ready for the usual cleaning.

[*No Drawings.*]

A.D. 1881, May 20.—No. 2219.

IMRAY, John.—(*A communication from Pierre Emile Martin.*) —Alloys containing iron and steel.

Especially to produce tool steel; "ores of metals and " metalloids, besides those of iron, manganese, or silicon, that " is to say, of tungsten or wolfram, chromium, titanium, cobalt, " nickel, aluminium, magnesium, sodium, potassium," may undergo complete reduction and carbonaceous, nitrogenous, or hydrogenous cementation by prolonged contact with " carbon " and substances containing cyanogen or hydrogen, cyanides,

"ammoniacal salts, carbonates, tartrates, nitrates, hydrochlorates, "hydrocarbons," etc., at a bright red heat in horizontal, vertical, or rotative retorts; somewhat tapered tubes, heated by a regenerative furnace flame, smelting furnace gases, or the combustion of inferior fuel, being preferred. Or cupolas or crucibles may be used. The mixed materials can be formed into lumps with lime. The spongy products obtained as above described are melted in a cupola or smelting-furnace, with or without iron or iron ore, to produce ferro-carbide alloys. The iron employed "may have been dosed with manganese or the like." If crucibles be used, this fusion as well as the previous reduction and cementation may take place in them.

The ferro-carbide alloys may be introduced into the bath of metal in the Siemens-Martin furnace in producing steel. The iron is melted in two heats. The first melting should be with charcoal and hydrogenous or other converting materials. The sponge can be introduced directly into the bath without previous alloying. The introduction of the sponge or alloy developes great heat, which volatilizes impurities, such as sulphur or phosphorus. An analysis of a "chisel steel" shows 0·835 of carbon and 0·01 of tungsten; and that of a "file steel" shows 1·761 of carbon and 0·496 of tungsten.

Alloys of other metals or metalloids, such as above specified, may be likewise obtained for producing new qualities of steel. If such alloys "cannot be run as steel direct from the smelting "furnace" they may be used in the Siemens-Martin or other furnace or in the Bessemer converter.

[*No Drawings.*]

A.D. 1881, May 24.—No. 2260.

WISE, WILLIAM LLOYD.—(*A communication from Karl Heinrich Kühne.*)—Alloy.

An alloy, having great resistance or toughness combined with softness, and suitable for bearings etc., may be made by melting about 83¼ p.c. of copper with 7 of tin, and adding ¾ p.c. of phosphorus to the molten metal while being stirred. Lastly, 9 p.c. of lead is added, and the whole is well fused. The alloy is cast in as cold a state as permissible.

[*No Drawings.*]

A.D. 1881, May 26.—No. 2325.

CLARK, Alexander Melville.—(*A communication from William Henry Howland.*)—Crushing and pulverizing ores ; and saving gold and sulphurets in sluices and flumes.

1. The rim of a shallow pan has a flange projecting outward around its upper edge, whereon there can be secured a sloping cover with a narrow horizontal rim extending inwards from its upper edge, the centre of the pan, into which the ore is fed, being left open. The pan is provided with a driving muller actuated by a vertical spindle, which passes down through the bottom of the pan and is driven by power applied beneath. At intervals on its inside the rim of the pan has ribs or lugs, forming rectangular bearings for a heavy chilled iron or steel annular die, which rests on horizontal lugs, while its outside bears against vertical lugs. This die which is rectangular in cross section, forms a stationary track round the pan inside its rim. The muller has a plain bottom portion, either a permanent part of it or attached to it by cross arms, and is adjustable up and down so that it can be raised clear of the bottom of the pan ; the upper face of the muller bottom will then be level with that of the horizontal part of the annular die. Short cylinders or rollers are placed upon end on the bottom of the muller, and assume position one behind another in a circuit round the pan when the muller rotates. The cylinders rest partly on the horizontal part of the stationary die and partly on the outer rim of the muller, and will rotate with the latter, moving round the pan, while the centrifugal force will carry them outward against the vertical face of the die. Besides the said circle or series of cylinders, an inner concentric circle of smaller cylinders may be also used, the whole travelling together. The cylinders may be tubular and perforated for the escape of any entering pulp. A water-supply pipe of an approximate U shape has one arm extending above the pan and the other passing up through its bottom. Thus, water is introduced beneath the muller to lubricate and buoy it up ; while the water pressure prevents pulp or particles of ore from getting beneath it. Screens are fixed in openings in the sloping cover, so that the splash against them will discharge the sufficiently ground pulp, or an upward current discharge could be provided between the die and rim of the pan. In this space amalgamated plates are placed, usually one plate on each side of the space, so that

the pulp will be brought into contact with the plates. The cylinders present a large grinding-surface ; their lower ends grind against the die and muller, while their sides crush the ore which is caught between them and against the die, the entering ore being hurled centrifugally outwards to the cylinders. The water is likewise carried to the periphery, so that, as the ore is ground fine enough, it passes through the screens or other discharge. Much of the pulp will pass between the die and rim of the pan, where any free particles of gold will be arrested and caught by the amalgamated surfaces. Large particles, which fail to be discharged, fall or circulate back to the cylinders, complete pulverization being ensured.

2. Covering the bottom or floor (for a certain length) of a mining flume or sluice, through which auriferous material is carried by a current of water, there are located cast-iron riffle sections in rows lengthwise upon the bottom, the ends of the sections in one row coming opposite the middle of those in the adjoining row, and the sections of each row abutting end to end. Each section is like a ridge roof, the incline on each side of the ridge or apex has numerous parallel slots extending its entire length, the slots on one side alternating with those on the other. The metal, *i.e.* bars, between adjacent slots may be hollowed out on the upper surface to form grooves, which are therefore in line with slots on the other side of the ridge ; but the construction may be varied. At the bottom of each incline is a transverse shallow box or trough containing quicksilver, and carrying the ends of the sections ; the grooves lead into these boxes. A vertical partition extends from the under side of the said ridge to the floor of the sluice, and may be hollow and contain quicksilver ; thus forming a riffle bar or obstruction to arrest heavy particles, and supporting the middle of the section. As the water carrying auriferous material moves down the sluice, it will strike the upper incline, and much will pass through the slots into the chamber beneath : while large particles and some fine particles will follow the grooves up over the quicksilver in the hollow partition, and thence across and through the slots on the opposite side or over on to the next section. The partition will arrest the portion entering the said chamber, heavy particles settling, while the water and lighter portions pass out

through the open side of the chamber and diagonally across upon the incline of the section in the adjoining row, where the operation is repeated. Thus the current is broken and directed from section to section throughout the covered length of the floor of the sluice, a slow upper current and quick-moving and broken under current being produced. The cross currents, caused by alternating the adjoining sections, prevent the sand and clay from packing, and wash the sulphurets and heavy particles clean. The ridges and the sharp corners of the grooved bars present a roughened surface to large or heavy lumps, disintegrating and pulverizing them and thus liberating contained particles of gold or sulphurets, the considerable loss in hydraulic mining with the old style of riffle being thereby avoided. The free particles of gold are amalgamated by the mercury in the boxes, over which they have to pass, and thus saved, any quicksilver or amalgam escaping from the boxes being caught in succeeding sections with the sulphurets and other heavy particles. Small riffles of this kind may be used below batteries for catching free gold, quicksilver, and amalgam. Sometimes the quicksilver troughs and the grooves in the bars can be dispensed with.

[*Drawing.*]

A.D. 1881, May 27.—No. 2334.

CLARK, Alexander Melville.—(*A communication from Jules Garnier.*)—Metallurgy of copper.

Such matters as arsenic, antimony, and phosphorus, which by oxidation form acids, are not easily eliminated in refining metals, like copper, in furnaces with silicious linings. The arsenic, antimony, and phosphorus may, however, be eliminated from crude copper or matt by refining on a hearth of basic material, on which at each operation is spread a layer of basic and oxidizing matters, such as lime or magnesia, raw limestones, or dolomites, with peroxide of manganese, litharge, fluor spar, etc. The basic fluxes should suffice to saturate the acidifiable impurities present, while the carbonic acid disengaged from the carbonates stirs up and oxidizes the charge. The copper and matts are melted under an oxidizing-blast, the fire is then urged, the slag skimmed off, oxidation recommenced, and skimming repeated until the said impurities are almost wholly

removed. The iron present is also partly removed, but it should be eliminated in a separate previous or subsequent operation on a silicious hearth, whereon the copper may be refined until it contains only about one-half per cent. of iron, and then refined on a basic hearth to eliminate the rest of the iron and sulphur and particularly the said impurities. The operation is hastened by using the high temperature of a regenerative furnace and a revolving hearth, which brings all the metal well into contact with the basic lining. The stationary hearth is of lime or calcined dolomite, agglomerated with clay, and fritted by the heat. The sides of the furnace are rammed with this material, surmounted by a thin parting of lime, magnesia, or even alumina, which melts neither with the silica bricks of the arch nor with the basic walls. The hearth proper is fritted in thin layers at the same time as the basic mixture of the walls. The sides of the rotary hearth are lined with basic bricks, and the hearth is made as above described.

[*No Drawings.*]

A.D. 1881, May 27.—No. 2340.

TURTON, THOMAS, and ALLIBON, GEORGE.—Screw propellers.

The propellers are cast in iron or steel, pickled, and cleaned by acid, and dipped in a bath of molten zinc or like metal.

A bath with radial bays to receive the blades is used, or the blades may be dipped in succession into a deep pot.

[*Drawings.*]

A.D. 1881, May 28.—No. 2356.

BELL, THOMAS, junior, and RAMSAY, WILLIAM.—(*Letters Patent void for want of final Specification.*)—Washing coal and other minerals etc.

The washing of coal is described. The coal is placed upon an inclined semi-cylindrical trough at the higher end, and a stream of water is directed along it to carry forward the coal. A rotating axis, passing along the trough from end to end, has arms or stirrers and keeps the contents of the trough in motion. Ledges within the trough stop the heavier matters from passing onwards, the ledges (as well as the axis) not being fixed to the

trough but carried independently. When the trough contains a certain quantity of matters (mineral impurities) stopped by the ledges, it can be dropped away or removed from the ledges and stirrers to discharge the matters into a receptacle, the trough being fixed near its upper end to an axis, and suspended near its lower by the aid of counterpoises.

[*No Drawings.*]

A.D. 1881, May 28.—No. 2359.

MACAY, Juan Francisco Nepomuceno.—Apparatus for filtering, and for dissolving or extracting constituents from minerals etc., by solvents or chemical agents.

Apparatus, to which the inventor's prior Specification No. 4968, A.D. 1880, relates, may be improved.

The asbestos cloth or other filtering fabric may be supported with the least obstruction to the filtering-surface. The holes in the inner cylinder or shell are made small, but are countersunk on the inner side to obstruct as little as possible of the cloth; which is supported only by the narrow surfaces left between the countersinks. A packing or bed of coarse porous fabric, preferably asbestos, is interposed between the cloth and the surface of the inner shell to further increase the effective filtering area. Again, the inner surface of the inner shell may be fluted or grooved longitudinally and the cloth be supported by the intervening angular ridges, holes communicating with the outer space. Longitudinal divisions, which generally divide the annular space between the two shells, may be built into the outer shell, while the staves or slabs of the inner shell are built in between them. Porous sandstones or artificial silicates or unglazed earthenware may sometimes form the filtering material, of which the inner shell may then be entirely constructed.

The outer barrel or shell may be constructed of wooden staves, jointed together and hooped, with longitudinal divisions of earthenware, porcelain, glass, or other material not acted on by the solvents, built up with them. This barrel is lined with slabs or tiles of the same material as the divisions, and laid upon a bed of felt or other soft material, the joints, purposely made wide, being caulked with asbestos steeped in boiled linseed oil. Some of the slabs have sockets passing through holes in

the staves to receive drawing-off cocks. The inner barrel is constructed of slabs, which, if perforated, would be of like material to the said lining, or which, if unperforated, would be of porous sandstone or silicate or unglazed earthenware and might then be used with or without the asbestos cloth. These slabs are moulded with feet at back, which bear against the lining (with a packing of asbestos cloth between) and maintain the needful intervening space to collect the filtrate. The heads of the outer barrel may be lined with glass slabs having mouth-pieces formed on them to line the doorway in the head, the doors being also glass slabs, and an asbestos joint being made between the door and the face of the mouth-piece.

The material forming the inner barrel should be hard enough to withstand the friction of the matters treated. It is preferably the internal surface (of the inner barrel) which is covered with the filtering cloth. The ends of the two barrels are closed by heads, one or both of which can be provided with pipes and connections, such as centre valves, for blowing steam, air, or gas into either the inner or outer barrel or for exhausting the air or any gases given off.

The apparatus might be used for amalgamation of auriferous or argentiferous ores and separation of the amalgam by filtration, the annular space between the two barrels being advantageously very small in this case.

[*Drawings.*]

A.D. 1881, June 8.—No. 2486.

BAUER, Maurice.—(*A communication from Auguste Combes d'Alma and Frederic Girot.*)—(*Provisional protection only.*)—Employing gases in smelting or reducing.

"The invention relates especially to means and apparatus for "conducting gases produced from wood or cork in special "retort ovens into furnaces" for smelting or reducing ores or minerals. To save tar and other bye-products, the gases are passed through a condenser; and are then conveyed into a gas holder to secure "a certain distribution and regular mixture "of the gases with air," according to the heat desired. Thence the gases are led to special receivers, surrounding and communicating by pipes with a blast furnace.

The shell of the furnace consists of three parts; the inner

part is of firebricks, and the second of special bricks or refractory mortar, for insulating the inner from the outer part (which latter forms the actual body of the furnace), while allowing the inner refractory lining to expand. The top of the furnace is hermetically closed by two dampers, moved by counterbalanced levers. A block of very refractory stone, with an upper surface of lime, supports the limestone and mineral; "at the upper "circumference of this block the smelting of the raw ore is "effected." Below this block is the hearth with an opening for the overflow of cinder and a tapping-hole for the molten metal. Besides the gas receivers and supply pipes, an air receiver and pipes likewise supply air to the flame at the upper edge of the said block and also over the hearth. Each air pipe is joined to a gas pipe and forms therewith a blowpipe. These pipes are "nearly tangential to the inner circumference of the "furnace." There are pressure gauges and regulating cocks, the proportion of gas to air being about 1 to 10. Sight-holes are provided. The gases of combustion escape through pipes laid in a coil round the furnace in the insulating part.

[*No Drawings.*]

A.D. 1881, June 8.—No. 2494.

FRENCH, Andrew.—Treating lead and zinc ores, etc.

Ores or materials, obtained as products or residues and containing lead and zinc (including residues from the wet treatment of complex ores), may be operated on, sulphuretted ores being first changed into oxides and sulphates by calcination, which also helps to eliminate volatile substances like arsenic, selenium, and antimony.

A low cupola smelting-furnace, square in plan, is employed, its lower part being smaller than the upper, the walls of which are supported on a plate resting on the lower walls and on pillars. An arched top with flat end walls closes in the upper part, an outlet for the gases and volatile matters being in one end wall at the top. The charging-door is just above the lower part, which has a brasque bottom and a tymp and fore hearth plate. As to height, flame should be always present at the top of the charge, but a sufficient column of incandescent materials be maintained to prevent too great cooling when fresh

materials are charged ; the charging-door may thus be advantageously from 15 to 30 inches above the tuyère. Preferably hot blast is supplied at the tuyère, the air being heated in traversing horizontal pipes, crossing the upper part of the furnace, and having holes in their upper parts, whence jets or currents of air issue into the upper part of the furnace. The invention relates to obtaining white sublimates, consisting principally of mixed sulphites of lead and zinc, for use as pigments, and the said jets of air are to ensure complete combustion of all particles of fuel and of reguline vapours of lead and zinc. Coke, charcoal, or other comparatively smokeless fuel should be used. The furnace is so worked as to convert part of the lead present into a sublimate, and to reduce at least sufficient to absorb or hold the greater part of the silver and gold present. The reduced metal is tapped as usual into moulds.

Fumes obtained in ordinarily treating lead and zinc ores etc. may be operated on according to this invention, after they have been agglomerated by calcination, and the small quantity of silver present in such fumes becomes concentrated in the reduced lead and is rendered worth separating, while the pigment produced is better for its absence. Litharge containing silver may be treated to yield partly lead, wherein the silver is comparatively concentrated, and partly a white sublimate consisting chiefly of carbonate and oxide of lead for use as a pigment.

The conducting of the sublimate to a wet condenser and the advantages of the latter are described.

[*Drawing.*]

A.D. 1881, June 10.—No. 2537.

DICK, GEORGE ALEXANDER.—(*Provisional protection only.*)—Alloys.

Phosphuret of iron may be employed to deoxidize any oxide present in copper or in such alloys as brass and gun-metal, and to increase the tenacity, hardness, or strength of such copper or alloys by the introduction of iron. To obtain improved alloys, phosphuret of iron may be added to gun-metal and brass, all or part of the phosphorus remaining in the perfected alloy. Up to 10 p. c. of phosphuret of iron may be employed according to

requirements. To introduce much iron when not much oxide is to be disposed of, phosphuret containing much iron and little phosphorus must be used, and *vice versâ* ; also the phosphuret must contain more phosphorus when used for making alloys containing phosphorus, than for deoxidizing only. The oxygen of the oxide is taken up in the melting process by the phosphorus, the resulting slag being skimmed off the molten metal, while the iron is alloyed with the copper and other metals, if present. The phosphuret is either melted with the copper or tin used in forming the gun-metal or brass, or with the latter afterwards. The perfected alloy containing phosphorus is thereby rendered more fluid when molten, and can be remelted repeatedly without losing its fluid nature.

From 2 to 10 p. c. of lead may be added (before, during, or after the addition of the said phosphuret) to the gun-metal or brass as used for bearings, allowance being made for any lead already present.

[*No Drawings.*]

A.D. 1881, June 10.—No. 2540.

HALL, Charles Edward.—Crushing-machinery having safety appliances and elastic connecting-rods.

Elastic or safety connecting-rods, links, or clutches may be introduced between the driving-mechanism and the operating-surfaces in crushing, stamping, or otherwise reducing stone, minerals, etc., by jaws, rolls, stamps, etc., to prevent harm from undue strain. Where high speeds are needed, connecting-rods may be used in the form of a loop, centrally containing one or more steel or other powerful (preferably circular, elliptical, or volute) springs, which will allow the rod to collapse in the centre and thus lengthen under undue tensional strain ; or a connecting-rod, composed of a cylinder and piston enclosing an air cushion, may be employed. Drawings illustrate the invention. In a stone-breaker with jaws, the spring elastic connecting-rod is shown as connecting the toggles to an eccentric shaft above them. This shaft revolves in an adjustable pedestal, which allows the connecting-rod to be raised and lowered and the toggles to be placed more or less out of the horizontal line, the stroke of the crushing-jaw being thus adjusted. A like connecting rod is shown as connecting the axes of a pair of

crushing-rolls. In another arrangement thereof, one end of the rod appears to be fixed and the other to be fitted with a screw and nut for adjusting one of the rollers towards or from the other. When using a cylinder and piston enclosing an air cushion, the working pressure may be transmitted from a crank through the pneumatic connecting rod and toggle plates to the stamp head. The air is alternately free and under pressure, owing to apertures in the cylinder being closed and opened alternately by the moving piston, the power being applied to the piston and rod at one end, while the working resistance is received on the cylinder end, or *vice versa.* The blow may be increased or diminished by regulating a valve or cock to relieve the pressure in the cylinder. One toggle plate is shown attached to an adjustable block, moving through a bracket and fixed by two screwed collars.

In the case of lower speeds, the inventor alternately uses abutments or connecting-rods in the form of pistons and cylinders charged with oil or water and fitted with a relief valve or cataract. A toggle block may be attached direct to the piston and the cylinder be fixed overhead to obtain a direct hydraulic pressure upon the block ; or the piston-rod may receive the direct thrust or pull of the driving power and the cylinder receive the working strain, or *vice versa.* A differential pump may give augmentation and relief of pressure in the oil or water cylinder. For this purpose, parallel with the bore of the cylinder there may be arranged a small pump piston or plunger of two different diameters working in two stuffing-boxes or bushes. The smaller area is open to the water in the cylinder and thus to any variation of pressure in the working resistance. The larger area communicates through a port and valve into or through a bye-pass leading to the cylinder, the pressure therein being always on the top of the valve. To the other end of the pump rod there is attached a lever with weights or a spring adjusted to the pressure to be resisted. An extra strain will depress the plunger, and its removal will cause the plunger to rise again and return the water to the cylinder. By releasing the lever from the spring, additional water may be pumped through the said bye-pass and valve into the cylinder by reason of the differential diameters of the plunger and the action of a suction valve ; thus the position of the toggle motion in regard to the cylinder may be altered.

Sometimes a safety friction driving-clutch on the first driving-shaft may be used. It is in the form of a circular casing, carrying either a pinion wheel or a pulley to transmit the force to the crushing-machine. The casing runs loose on a shaft, whereon a sliding block is fitted on a feather or key. To the block are attached two or more sets of toggles, operating two or more rigid or elastic segments of greater radius than the internal diameter of the casing and pressed outwards or drawn inwards by the toggles. This motion may be effected by a lever and stirrup. As the block is therefore thrust into the casing, the toggles force out the segments and a firm frictional grip is made between the block and casing, but the clutch will permit of slipping under great strain. Again, a hand-wheel may be used for forcing the segments (by the aid of a toggle motion) into frictional contact with a driving-pulley, the clutch being combined with a crank shaft.

[*Drawings.*]

A.D. 1881, June 14.—No. 2579.

CLARK, Alexander Melville.—(*A communication from Henry Dean Atwood and William Driscoll.*)—Moulds for forming crucibles etc.

Moulds having a cloth lining for the moulding surface are especially in view. The lining is to be combined with a skeleton frame mould and supporting backing, which may be rigid and non-porous, but is preferably flexible and porous for the escape of expressed water.

The mould described is made in two parts as usual with a longitudinal division. The frame consists of preferably wooden longitudinal ribs, cut out to shape, and secured to end pieces or ring segments by mortising and screws or otherwise. The backing, which may be of heavy cloth or other flexible porous material, is secured on the inside of the frame by tacks or staples, and is then shaped by blocking. The lining, which is of like material but finer, is secured within the backing. At the ends the lining, with or without the backing, may be turned back upon the end pieces and secured by segment plates of metal, which also protect the wood. The edges of the two parts of the mould may be rebated to receive the edges of the lining. The water, pressed from the composition, can escape

freely, and the lining will be kept comparatively dry. The ribs at the division of the two parts of the mould are fitted with springs, which help to separate the mould when the clamping-hoop is removed.

[*Drawing.*]

A.D. 1881, June 14.—No. 2580.

WEBSTER, James.—Producing alumina for the manufacture of aluminium.

Commercial alum, sulphate of alumina, or other salt or compound of alum is mixed with about one-third of its weight of carbonaceous matter, preferably gas pitch, which consists chiefly of carbon with a little sulphur. The mixture is finely ground and heated to about 400° or 500° Fahr. (but not higher) for about 3 hours in a flat-bottomed furnace with stirring and mixing, thus driving off the water of crystallization with a little sulphuric acid from the alum. The pitch and sulphur combine together with the dried alum, and the thick paste-like compound is cooled on a stone floor, broken in pieces, and moistened with a little dilute hydrochloric acid. A heap of the mixture is occasionally turned ; it heats and gives off sulphuretted hydrogen. Afterwards about 5 p. c. of wood charcoal or lamp-black is added, with a little water if needful, and the mixture ground down to a thick paste, which is made into balls pierced with holes for the escape of moisture, and is then thoroughly dried, first, in a stove heated to about 100° Fahr. and, afterwards, in an oven or stove at from 200° to 300° Fahr. The dried balls are put into a vertical fire-clay retort, heated to dull redness for about 30 hours, or the mixture in the heap, after sulphuretted hydrogen has been given off, may be conveyed direct to the retort. A mixed jet of about two volumes of steam to one of air is now passed through the heated mixture : thus the sulphur and ferric sulphate, with a little potass and a trace of alumina, are carried off with the vapour, and, by condensation, concentrated hydrochloric acid is obtained contaminated with free sulphuric acid, sulphate of potass and iron. The dried mixture from the retort is afterwards cooled, finely ground, and placed in a vat or pan with about seven times its weight of water. After boiling by steam for about an hour, the contents of the vat are allowed to cool, when the alumina will fall to the

bottom as a thick precipitate ; which, after further washing and drying, may be used for producing aluminium, anhydrous chloride of aluminium, etc. Sulphate of potass is held in solution by the water, which may be boiled down to obtain crude sulphate. The latter and the said hydrochloric acid form bye-products which reduce the cost of the alumina.

[*No Drawings.*]

A.D. 1881, June 17.—No. 2639.

EVANS, David, and TUCKER, Alexander Edwin.—Refractory materials for lining furnaces.

A composition is employed consisting of ground gannister, sandstone, or like silicious material (including silicious fireclay) mixed with tar or similar hydrocarbons, preferably with the addition of a little coal dust, to attain greater durability than when gannister is used in admixture with water. The materials are employed in such proportions as to form a hard yet plastic mass. Hot tar may be mixed under edge-runners or otherwise with about 10 times its weight of gannister. After a lining has been dried at about 100° Cent. for some 12 hours, the heat may be increased to "a black redness" and so continued while combustible vapours are evolved, air being excluded. In making the hearths of Siemens furnaces, the mixture may be either rammed or slurried, in which latter case the proportion of tar or like binding medium is increased so that the resulting mass will tend to spread. The invention is described with special reference to lining Bessemer converters and making converter bottoms and tuyères.

[*No Drawings.*]

A.D. 1881, June 17.—No. 2651.

SIEMENS, Charles William.—(*Provisional protection only.*)—Furnaces.

Reference is made to the prior Specification, No. 3374, A.D. 1880.

In the case of an open-hearth regenerative gas steel-melting furnace, to check the destructive action of scoria upon the sides of the bed of the melting-chamber, the inventor adds thereto pipes for circulating water round the bed.

Metal may be melted in a furnace, the bed or floor of which is steeply inclined, and terminates in a receiving basin with a tapping hole. The bed should be of a basic character, to react on cast iron which may be melted and purified thereon. There are flame ports at the lower or basin end of the bed, the passages to the chimney being at the higher end. The crown of the furnace has a double arch with an intermediate space forming a passage for air. The air, traversing conduits in the chimney flue and the said passage, becomes highly heated and, at the flame ports, meets gas from a producer ; which may be of the kind described in the prior Specification, to ensure a supply of rich combustible gas.

[*No Drawings.*]

A.D. 1881, June 18.—No. 2673.

FULLER, William James.—(*Provisional protection only.*)—Extracting silver and other metals from ores.

To obtain silver from sulphurous ores of silver and lead, it has been proposed to heat the ore with sulphuric acid to convert the lead into insoluble sulphate, while sulphurous fumes are driven off and passed into a leaden chamber for conversion into sulphuric acid by the action of nitrous fumes from nitrate of potash in the chamber. The inventor, however, takes the ore, after heating with sulphuric acid and washing to remove soluble salts, and saturates it with nitric acid ; and again heats the mass to convert silver and other metals, such as nickel and cobalt, into nitrates. All acid fumes thus driven off are passed into the leaden chambers, which receive the sulphurous acid driven off in heating the ore with sulphuric acid. Afterwards the ore is lixiviated with water to remove the nitrate of silver and other soluble nitrates and nitric acid. This solution, after concentration, may be used repeatedly until saturated with metal, and then be introduced into the leaden chamber to aid in converting the sulphurous into sulphuric acid. The silver may be recovered from the residue removed from the chambers, or it may be removed from the solution of nitrates by known means, and the residual nitrates mixed with sulphuric acid may be used for dissolving fresh quantities of silver.

[*No Drawings.*]

A.D. 1881, June 18.—No. 2683.

EVERITT, William Edward.—Ingots for brass and copper tubes.

Relates to the casting of hollow ingots for solid-drawn tubes. They are made rectangular in cross section with an axial circular or elliptical hole, and are afterwards reduced by rolling to cylindrical form, being then converted into tubes by rolling or drawing as usual. A trough-shaped rectangular mould is employed, open or partially open at the top, having a central metallic core or mandril, preferably elliptical in section, both being placed as horizontally as possible. The mandril is coated with phosphate of lime to prevent adhesion of the metal and is also heated before casting. The molten metal is poured into both ends of the mould simultaneously.

[*No Drawings.*]

A.D. 1881, June 18.—No. 2684.

RAMU, Henri Joseph.—Breaking stones, ores, bones, etc., and sorting the pieces.

In a metal case or chest there is mounted a rotatory shaft, having bearings on the outside of the case, and provided with series of radially projecting flexible or non-flexible arms, which may be of tressed steel, wire, aloes, leather, wood, etc. The free ends of the arms carry metal hammers or other tools, which in rotating break the stones etc. fed into the case through an inlet. The feed is promoted and regulated by a self-acting distributor, consisting of a duct or inclined plane, one end of which rests upon the side of the inlet, whilst its other end is shaken by a revolving cam shaft, or a shaft of square or polygonal section, or otherwise. Thus the stones etc. are spread and fed in regularly, so as to present their largest surface to the action of the hammers. The upper part and the front and back ends of the case have strong metal plates or anvils, sometimes roughened or armed with projections. The hammers break the stones etc. as the latter are in the act of falling upon them, and the pieces are projected upon the various anvils. The broken material may fall on to an inclined plane (sometimes dispensed with) at the bottom of the case, and is immediately conducted out of it and into a rotatory sorting or classifying apparatus, comprising a series of concentric cylinders

or polygonal drums mounted one within another upon an axis. The cylinders are perforated with holes of different sizes in the case of the different cylinders according to the size of the fragments intended to pass through each particular cylinder, the inner cylinder having the largest and the outer the smallest holes. Thus the broken material is sorted into sizes, and may be discharged from the different cylinders through side holes in connection with ducts or inclined planes within the cylinders. The inner cylinder contains rakes or elevating-plates, which carry up the fragments too large to pass through the holes of this cylinder, and discharge them into a hopper or inclined plane to be passed back into the case and again broken by the hammers. One sorting-cylinder may suffice when classifying into several different sizes is not needed. A bracket on the side of the case supports bearings for the shaft of the classifying apparatus, the motion of which is independent of that of the hammer shaft.

In a modified machine the hammer shaft has rigid arms the free ends of which carry long rectangular hammers or beaters, disposed in pairs, and extending from end to end of the case; the portions of the case provided with asperities, where the material is projected by the hammers, are somewhat differently arranged.

[*Drawings.*]

A.D. 1881, June 23.—No. 2750.

BOWER, George.—Coating metals.

Consists in producing ornamental deposits of metals upon iron and steel surfaces coated with magnetic oxide, by rubbing such surfaces with a brush or other device having filaments etc. composed of or coated with the metal it is desired to deposit. Gilding, silverizing, and platinizing may be effected by this process.

[*No Drawings.*]

A.D. 1881, June 25.—No. 2797.

LLOYD, Samuel.—Purification and use of gases.

To precipitate dust and cleanse blast-furnace gases from solid particles (including the condensation of tar and other volatile matter), the inventor passes the gases through a cylinder or

casing containing a series of cooling tubes, " which may be " flattened or corrugated through the greater part of their " length but cylindrical at their open ends," and which are cooled by passing water or air through them (or the gases may be passed through the tubes and the water or air be externally applied to them). Horizontal shelves or trays with perforations may be fixed in the cylinder to deflect, retard, and divide the passing current of gas. Also into the top of the cylinder there may be injected sprays of water, which are further divided by the shelves and splash against the interior of the cylinder, thus effecting condensation and cleansing the gas. When needful, a draught can be maintained through the apparatus by means of a fan or blower. The apparatus may be cleansed from the tar and refuse matter of the gases by injecting steam or water at a high temperature. The cylinder may be rotated to increase its efficiency.

In using the gases, separate pipes may convey the gas and compressed air, which are mixed together where the gas is ignited. The intensity of the resulting heat may be increased by using regenerators to heat the gas and air prior to combustion. In the case of kilns for calcining ores, a gas exhauster or fan may be used to direct the said purified gases (or generator gases likewise treated) in larger or smaller quantities in the required direction and with the required pressure to calcine the ore to the extent desired.

[*No Drawings.*]

A.D. 1881, June 28.—No. 2825.

HUNT, Edmund.—(*A communication from John King*).—Magnetic separators.

For operating on ores containing magnetic iron or oxide, or for separating iron from brass turnings etc., the granular or powdered ores or other substances are placed in a hopper, the bottom of which has an opening of adjustable width extending across the machine, so that the ores or other substances may descend therefrom in a broad thin stream in contact with or very near to a sheet of thin zinc or other material not affected by magnets. This sheet extends across the machine, and is " continued downwards with its upper part slightly inclined " from the vertical in one direction whilst its lower part is

"curved away in the opposite direction." A loosely-hanging flap or plate prevents the stream from deviating too far from the sheet. Behind the sheet a gang or series of magnets is carried in transverse rows by a frame, which is adjustable relatively to the sheet by the aid of screws. Opposite the lower end of the sheet there is an inclined shoot, having an adjustable plate with an inner edge directed upwards, an opening being left between this edge and the bottom of the sheet. As the stream descends along the surface of the sheet the particles of iron, steel, or magnetic oxide are attracted by the magnets and adhere to the sheet, but not sufficiently to prevent their sliding downwards; and they ultimately drop into the said opening, while the other substances pass off by the shoot.

[*Drawing.*]

A.D. 1881, June 28.—No. 2834.

FENWICK, George, and COCHRANE, Brodie.—Reverberatory furnaces.

One or more "fire chambers" are formed over the top of the furnace, communicate at the rear end with the combustion or reverberatory chamber by one or more small openings controlled by valves, and terminate at the front end in the closed ashpit. Brick or other baffles, placed at an angle, are arranged so that flame entering from the reverberatory chamber may pass freely along the said chambers to the ashpit and thence over and through the fire-bars to intensify the heat, while the return through the said chambers of gaseous products under the draught of the chimney is obstructed. One or more "air "chambers" may be also constructed over the furnace conveniently between two fire-chambers. Cold air may pass into a hot chamber beneath the hearth of the furnace, whence the air is led by heated passages into the air chambers and, becoming highly heated therein, passes into a mixing-chamber, which also receives the flame gases from the fire-chambers, the mixture produced passing through the fire and further intensifying the heat.

On closing communication with the chimney by a damper, a circulation of the products of combustion may be maintained from the reverberatory chamber through the fire-chambers and back to the reverberatory chamber.

[*Drawing.*]

A.D. 1881, June 30.—No. 2860.

LONGSDON, Alfred. — (*A communication from Frederic Alfred Krupp.*)—Producing sound ingots etc. of metals and alloys, such as copper or bronze.

To produce non-porous ingots, the molten metal (or alloy) is subjected to a high pressure of gas in moulds constructed to withstand a high internal pressure. After the molten metal has been poured in, the mould is tightly closed, and communication is then made by a pipe between the space above the metal and a strong flask or reservoir, containing a substance in liquid or solid form, such as carbonic acid, which under ordinary pressure and temperature is a gas, and which can be kept under great pressure. The flask is placed in a bath of water, oil, or other fluid, which by the admission of steam or water can be heated or cooled in order to regulate the degree of pressure employed. To keep the upper part of the molten metal in the mould hot as long as possible, while the ingot gradually and evenly cools and contracts; the upper part only of the mould has a lining of refractory material, and a layer of molten slag may be poured on to the surface of the molten metal in the mould; also a thick cover of a refractory material which is a bad conductor of heat may be dropped on to the top of the molten metal or slag. The pressure is maintained as long as there is any tendency for hollow spaces or pores to form in the ingot. The mould may be strengthened by wrought-iron hoops. A strong cover is secured to the mould by bolts and cotters, a gas-tight joint between the two being obtained by a metallic ring (of which different kinds are described) placed in a recess or groove; or plumbago, asbestos, millboard, etc. may be used for the joint. There is a pressure gauge, and a valve regulates the exit of the carbonic acid gas from the flask to the mould. The metal may be run into the mould from the top (in which case the cover is afterwards secured) or from the bottom (in which case the inlet funnel is afterwards closed against internal pressure, and a valve for allowing air to escape from the mould is closed before admitting the gas). Again, the cover of the mould itself may be provided with an inlet funnel, having a cone plug which can be afterwards fastened down in its seat by a screw and nut; or the funnel may have a closing cap. Or the mould employed may have a closed top with the exception of a hole, through

which the metal is poured in and which is afterwards closed by a cover.

[*Drawing.*]

A.D. 1881, July 2.—No. 2881.

ELLIOTT, Arvid Henry.—(*Provisional protection only.*)—Crushing and drying or heating.

The manufacture of artificial stone is described, but some of the operations are applicable to preparing ore for separation or amalgamation.

Minerals, supplied from a hopper, are reduced to lumps in a crushing-machine provided with a stationary and a vibrating jaw, and thence pass through a shoot and between a pair of revolving crushing-rolls, which reduce the mineral to small lumps or granules. The crushed mineral is raised by an elevator to a revolving screen, which separates any too large lumps and returns them to another pair of rolls, whence the material passes to the elevator again ; uniformity in size is thus ensured.

A drier, which may be used between the jaw crusher and the roller crusher, but generally after the latter, has a charging hopper at the top and four approximately vertical walls, and across between two opposite sides are two vertical ranges of metal slats, each slat inclined inwardly and lapping under the slat above it, somewhat like Venetian blinds. The space between the two ranges is filled with the pulverulent mineral, which forms a vertical sheet thin enough for the hot air in the flues between the walls and slats to have free access for drying and heating it. A fire at the lower part supplies heat. The mineral descends as it is removed at the bottom ; a revolving scraper or elevator is used to effect removal regularly.

[*No Drawings.*]

A.D. 1881, July 5.—No. 2926.

BONNEVILLE, Henri Adrien.—(*A communication from William Moller.*)—(*Complete Specification but no Letters Patent.*)—Metallurgical furnaces.

The furnace described with reference to drawings has four retorts, shown as arranged in pairs back to back within the outside furnace walls. The fireplace is shown towards the middle of one end of the furnace, with an arch over it extending from

end to end of the furnace. The arch is closed at both ends, but has openings in its sides and one opening in its top. Transverse walls extend up above the retorts and support the top of the furnace ; openings in their outside lower corner allow the heated gases from the fire to pass along the length of the furnace. A longitudinal wall extends between the retorts and also supports the top of the furnace. Near the front end of this wall is a damper for an opening in the middle of tiles, which rest upon the transverse walls, and protect the bottoms of the retorts from the direct action of the fire. This opening corresponds with an opening in the top of the fire arch. When the damper is closed, the gases from the fire pass through the lateral openings in the arch and circulate around the retorts, but when the damper is open, most of the gases pass through flues between the longitudinal wall and the retorts to the stack, thus lessening the heating of the retorts. Air, admitted through channels, traverses flues in the structure of the furnace becomes heated (sometimes partly in the sides of the retorts), is conveyed by pipes into the retorts, and promotes the combustion of the sulphur, phosphorus, arsenic, and like impurities contained in the heated ore within the retorts. On the top of the furnace are pans, one over each retort. The bottom of each pan has an opening communicating by a channel with an opening in the top of the corresponding retort. Into each channel is placed a flue, which is provided with a damper and with an opening in its side to be closed by a gate. On opening the gate, the powdered ore, which has become heated in the pan, is dumped into the retort below. The fumes from the retorts can escape through these flues when the dampers are open. Each retort has a mouthpiece with doors and an opening, through which the contents of the retort can be raked out on opening the doors. The arrangement and number of retorts may be varied.

[*Drawing.*]

A.D. 1881, July 5.—No. 2932.

MEWBURN, John Clayton.—(*A communication from La Société Raynaud, Bechade Gire et Compagnie.*)—Alloys.

A white metal and a laminable or malleable bronze may be manufactured by the decoloration of copper by means of ferro-manganese of high standard without the aid of nickel.

Oxide of manganese is reduced in a blast or other furnace, and, when ferro-manganese containing 80 parts of metallic manganese, 14 of iron, and 6 of carbon has been obtained, the first melting is made in a reverberatory furnace. About 60 p. c. of the ferro-manganese, and 40 of copper are mixed together, adding fluxes. When the mixture is melted on the hearth, it is run into ingots. The composition gives a metal as white as silver and as malleable as German silver generally obtained with nickel.

To obtain a laminable white metal in plates, the metal obtained as above is again melted with about 20 or 25 p. c. of zinc and brass ; it is run into ingots. After reheating (by heating to cherry redness and then acting by a current of carbonic acid, which removes any remaining slight impurities), it is laminated in the ordinary way. This metal is inoxidizable with the fatty acids and stearic acid.

Armour plates can be made with the first metal (from the first melting) by casting and rolling; numerous other applications are indicated.

A malleable or laminable bronze is obtained by proceeding differently. Protoxide of manganese and protoxide of iron are taken with the necessary fuel to reduce these oxides to the metallic state, and copper is added in the proportions above indicated. On melting the two metals, a malleable bronze resembling aluminium bronze is obtained.

[*No Drawings.*]

A.D. 1881, July 20.—No. 3154.

BROWN, JEREMIAH.—(*Provisional protection only.*)—"Manu-" facture of melting and annealing pots."

" Pots for melting or annealing malleable or other iron or " other metals " may be made of Bessemer or other steel. They are cast of any suitable form and size, and are then annealed.

[*No Drawings.*]

A.D. 1881, July 21.—No. 3188.

LAKE, HENRY HARRIS. — (*A communication from Léon Létrange.*)—Malleable bronze.

The alloy of copper and tin, termed bronze, and especially gun-metal (which contains within a few units 90 p. c. of

copper), may be rendered malleable and homogeneous by using manganese or phosphorus, or both, in making it. By introducing into the bath of fused alloy a substance (such as manganese or phosphorus) having great affinity for oxygen, the oxygen present in the alloy is absorbed and carried off in combination to the surface of the bath. Only sufficient of the substance to carry off the oxygen is employed ; the use of a larger proportion, to harden the metal, being avoided. Manganese is used in the state of cupro-manganese or phosphuret of manganese. Phosphorus, which is preferred to manganese, may be introduced into the bath in its natural state and incorporated by rapid stirring. It may be produced by contact of the melted metal by the decomposition of phosphorous material. It is preferably introduced, in the state of phosphuret of copper or phosphuret of manganese previously prepared, either into the molten copper or into the tin, or into the alloy at the time of tapping. The bronze thus deoxidized becomes remarkably fluid, and when cold can be rolled and worked ; it is elastic, tenacious, and sonorous, resists oxidation, has a fine and close grain, and resembles gold in colour ; so that it may replace some other alloys and metals. Nickel, tungsten, wolfram, or other metals may be added to harden the alloy without destroying its malleability. Bromine might be used. Directions are given for working the bronze. The molten alloy should be cast into plates in copper moulds, and be annealed before being rolled. It is rolled when cold and is annealed after each passage through the rolls ; the pressure is light at first and increases with each subsequent passage. The bronze may now be stamped, chased, or otherwise worked to produce various articles by means described.

[*Drawing.*]

A.D. 1881, July 22.—No. 3211.

LAKE, Henry Harris. — (*A communication from Léon Létrange.*)—Obtaining zinc from ores, etc.

The claims are for the conversion of zinciferous materials into soluble sulphate or sulphite by means of the sulphur contained in blendes ; and for the reduction of sulphates or sulphites of zinc by means of electricity developed from mechanical force.

In treating blende, it is first roasted or calcined at a moderate temperature and with precautions for transforming the sulphide of zinc into sulphate ; as little sulphur as possible escaping into the air. Calamine may absorb the sulphurous and sulphuric acids produced by the roasting, which may take place in a reverberatory or other furnace or in heaps. The sulphate of zinc produced is dissolved in water and decomposed by an electric current, which precipitates the zinc as metal, and renders the sulphuric acid available for use repeatedly for dissolving fresh quantities of oxide of zinc or for independent purposes. In the case of calamine or oxides of zinc, there may be introduced in their treatment sufficient blende to furnish the quantity of sulphuric or sulphurous acid requisite to form a permanent bath of sulphate or sulphite of zinc and to compensate for loss. Lead, silver, and other useful constituents of the ore can be collected or recovered from the residues.

The apparatus for reducing sulphates and oxides of zinc include a set of vessels wherein the zinciferous material is transformed into sulphate, a motor or driving engine (a fall of water, when available, obviating the need of steam), a "Gramme" or equivalent electrical machine, and another set of vessels wherein the zinc is precipitated. The ore, consisting of blende roasted as described, or of a mixture in definite proportions of blende and calamine or oxide of zinc, is placed in the dissolving vessels, which intercommunicate, and which are supplied with the acidulated dissolving liquid in such manner that the same becomes saturated with sulphate (or sulphite) of zinc as it passes through the vessels in turn, and the latter are successively deprived of oxide of zinc, emptied, and refilled. The solution of sulphate of zinc flows into a reservoir for feeding the precipitating-vessels, prior to which the sulphate may be purified from foreign matters, profitably recoverable or advantageously removable, to produce zinc free from any admixture and purer than that obtained by distillation. Lead and silver may be recovered from the residues in the dissolving vessels. The precipitating vessels contain thin sheets or plates of zinc serving as cathodes, on which the metallic zinc is precipitated ; or the cathodes may be of copper or polished brass, from which the zinc deposit is readily removable. In front of each cathode is placed an anode of carbon, platinum, lead, or other electrical conductor, either itself—or coated so as to be—

insoluble in sulphuric acid. Any arrangements employed for depositing other metals by electricity may be used. The solution of sulphate of zinc is regularly conducted by dip-pipes to the bottoms of the precipitating vessels. The decomposition of the sulphate sets free a proportionate quantity of sulphuric acid, which passes to the upper part of the bath above the sulphate, the latter being of greater density. The liquid at the upper part of the bath, which becomes continually acid, flows away through openings in proportion as more sulphate is introduced at the bottom : thus the sulphate bath is kept at the most suitable degree of concentration and acidity, and the production of zinc is regular. The acid liquid from the upper part of the bath may pass directly to the heaps of ore, or into a reservoir where its acidity can be controlled.

Sometimes, as when pure calamine is treated or the oxides of zinc arising from the fusion of metal, the arrangements may be simplified, the ore or the zinc ash being dissolved and the zinc precipitated in the same vessel. One set of vessels coupled together may be designed to receive, one, the anode surrounded by the material to be attacked and, the other, the cathode on which the zinc will be precipitated ; the one recipient contained within the other should be of porous material, like porcelain, stone, terra-cotta, or woven fabric, to prevent the deposited zinc becoming soiled or stained by the ore. Or long vessels divided by a set of porous partitions, between which are placed alternately the anodes and the cathodes, may be used. The ore or oxide of zinc, being a bad electrical conductor, is mixed with a little carbon, which, being a good conductor, connects the anode with the whole mass and aids its dissolution. If zinc ash or skimmings or residues of the fusion of zinc are treated, the metal therein will form a soluble anode and contribute to the increase of the zinc deposit on the cathode.

[*Drawing.*]

A.D. 1881, July 25.—No. 3238.

MILLS, Benjamin Joseph Barnard. — (*A communication from Georges Leclanché.*)—Purifying mercury.

Ordinarily purified mercury may be rendered absolutely pure, to be used for electric contacts for electric clocks etc., by submitting it to a current of dry purified hydrogen gas in a glass

globe or chamber, elongated at both ends, and heated to a temperature of "from 200° to 300°," whereby all the oxygen, which may have been dissolved in the metal, is extracted and all trace of oxide of mercury reduced to a metallic state. The globe is sealed at both extremities while the hydrogen gas is passing; for, if the mercury comes into contact with the air, it absorbs oxygen.

[*Drawings.*]

A.D. 1881, July 28.—No. 3304.

BARFF, FREDERICK SETTLE, BOWER, GEORGE, and BOWER, ANTHONY SPENCER.—Protection of metal surfaces and furnaces therefor.

Reference is made to the prior Specifications No. 862, A.D. 1876, No. 2051, A.D. 1877, No. 1280, A.D. 1878, and No. 3811, A.D. 1880; which relate to the same general subject.

A (preferably) cast or wrought iron chamber or retort, protected by fire-tiles on the outside, is externally heated by the combustion of gas furnished by generators, the products of combustion passing round the chamber. The waste heat is utilized in passing through flues, by generating and superheating steam in cast or wrought-iron pipes, which are fitted with pieces of iron or other good conductors, and into which water is admitted at the coolest end, to be converted into highly-superheated steam in its passage through the pipes. The articles to be protected by a surface-coating of oxide are placed inside the chamber by means of a rolling table, which is arranged to move freely upon rails outside the chamber. The articles are then treated by super-heated steam alone, or by carbonic acid and carbonic oxide. Petroleum or other hydrocarbon may be admitted into the chamber, to free the surfaces of the articles from rust, or to convert the rust into magnetic oxide by means of the rich gas produced by the action of heat upon the hydrocarbon.

[*Drawing.*]

A.D. 1881, July 28.—No. 3308.

VIVIAN, HENRY HUSSEY.—Bronze.

The addition of antimony in due proportion, instead of being injurious, is found by the inventor to increase the strength,

durability, hardness, and tenacity of alloys of tin and copper called bronze. An addition of from one-third to one-fifth per cent. of antimony strengthens bronze consisting of from 93 to 96 p.c. of copper and 7 to 4 of tin, about 0·03 p.c. more antimony being added for each reduction of a unit of tin. Such bronze may be cast, rolled, and drawn into sheets, wire, etc., it is malleable, ductile, and resists torsion, the rending action of gunpowder, and the action of sea water and acid solutions. It is preferred to use best selected copper and fine tin, and to add the antimony as an alloy of copper and antimony. Such an alloy, containing, say, 70 of copper to 30 of antimony, may be made by melting the copper in a plumbago pot under a little charcoal and gradually adding the antimony; after stirring, the contents should solidify in the pot to avoid loss of antimony through pouring. The final alloy may be made by melting the copper until it reaches the boiling point (indicated by the tremulous motion of a metal rod when inserted in the molten copper), then adding the tin and the antimony alloy with stirring, and bringing the metal again to the boiling-point. It is then taken from the furnace and stirred before pouring into the moulds, which are dressed over with resin, oil, and charcoal dust, or, sometimes with tar. To cast ingots for rolling, the moulds should be slightly concave to allow for shrinking of the metal in cooling and prevent the centre of the ingot from being hollow. Again, the alloy may be formed by adding tin and antimony directly to molten copper, or copper containing antimony may be used for introducing the antimony. The best mixture found for tensile strength is :—copper, 93·81; tin, 5·95; and antimony, 0·24.

An addition of from 1 to 2 p. c. of antimony to bronze bearing metal increases its durability and reduces the friction of moving parts. An approved mixture for bearings is :—copper, 83·0; tin, 15·5; and antimony, 1·5.

[*No Drawings.*]

A.D. 1881, July 29.—No. 3312.

HADDAN, HERBERT JOHN.—(*A communication from Fidèle Joseph Motte.*)—Refractory materials.

The more or less argilliferous sand, left in the manufacture

of glass, is mostly reduced to such tenuity that it acquires some plasticity, whatever the sand has carried away from the glass by friction contributing thereto ; so that the sand can be moulded, pressed, dried, and baked, the sand being previously eliquated. There is sufficient of fusible soda silicates or like substances in this refuse sand for cementing the silicious particles by baking. The process is specially applicable for making solid or hollow refractory bricks, slabs, etc., the resulting articles possessing great tenacity and small specific weight.

[*No Drawings.*]

A.D. 1881, July 30.—No. 3328.

LAKE, HENRY HARRIS.—(*A communication from Jouffray, Cl. and Chevalier, J.*)—Coal washing and separating machine.

The machine separates small coal into four products, schist fragments and dust, inferior coal fragments and dust, pure coal fragments, and pure coal dust. It consists of four depositing-troughs, with inclined planes between the first and second, and second and third. The coal being fed into No. 1 by a hopper and distributor and the agitating piston of No. 1 reciprocated, the schist dust falls through a perforated false bottom and settles at the bottom of the trough, whence it is removed by a screw conveyer to a well beneath the first inclined plane. Into this well the schist fragments drop, by passing through a regulated slit in the baffle separating the first trough from the first inclined plane. Both schist fragments and dust are removed from the first well by a bucket elevator working at the side of the inclined plane. The inferior coal fragments and dust are removed in a similar way by the second separating-trough and inclined plane, and the good coal fragments and dust pass on into a depositing-trough occupying one half of the end of the apparatus. The fragments are elevated from this trough by a chain of buckets, and the dust passes into a final large depositing-trough forming the return side of the apparatus. Having deposited its coal dust the water passes back under the chambers of the first two chains of buckets, and is pumped through valves into the first agitating trough by the motion of the reciprocating pistons, thus securing a complete circulation.

[*Drawings.*]

A.D. 1881, August 2.—No. 3336.

WISE, William Lloyd.—(*A communication from Lucien Guétat and Trénée Chavanne.*)—" Production of metals and " metallic alloys by the wet process."

" Insoluble salts which by their reduction furnish metallic " alloys are obtained in definite proportions by double decom- " position." To obtain " phosphide of copper, applicable for " the introduction of determined quantities " of phosphorus into copper or its alloys ; a bichloride of copper is mixed in equivalent proportions with artificial or natural phosphate of lime, producing insoluble phosphate of copper and chloride of calcium ; which latter is separated by washing. The phosphate of copper is reduced by any convenient method. At least sufficient lime should be added to the phosphate employed to ensure its being in the tribasic state. Modes of obtaining chromium iron and tungsten iron (for introduction into iron and steel) are also described.

" Silicate of copper, tungsten copper," chrome copper, manganese copper, etc. might be obtained. An alloy of copper and manganese might be produced by precipitation in mixed solutions of salts of copper and manganese by an alkaline carbonate ; the alloy being obtained by washing and reducing the resulting mixture of the two insoluble carbonates. If chlorides are acted upon, precipitation might be effected by lime or other base.

[*No Drawings.*]

A.D. 1881, August 2.—No. 3352.

HUGHES, Walter Watson.—Extracting copper and other metals from their ores.

Reference is made to the inventor's prior Specification No. 1847, A.D. 1881.

The sulphides or other ores of copper are first smelted in a cupola or reverberatory .furnace with fluxes, the slag being drawn off as usual. The regulus may be run into sand beds, remelted in a large reverberatory or other furnace, and (after drawing off any arising slag) run into a heated desulphurating furnace, or the molten regulus may be conveyed in a ladle from the first-mentioned to the desulphurating furnace. The main bed of the latter is longer than wide (say, about 9½ by 6½ feet),

and the depth from the level of the skimming plate to the bed is say, 1 foot. The main bottom has semi-circular ends, at one of which is a skimming door ; in front whereof the bed is stepped up, say, 6 inches, forming a platform and bay measuring 2 feet (along the centre of the furnace). Here the slag accumulates before being drawn off. At this end of the furnace is the culvert or chimney flue, made larger than in an ordinary copper-smelting furnace so that the sulphur fumes may not be driven out elsewhere; the fireplace being at the other end. There is a small door in each side, one door being near each end of the furnace, and opposite to these doors tuyères are set in the walls. Two tiers of tuyères are used, if advantageous from the depth of metal to be blown upon. The blast keeps the molten matters in rapid circulation with renewal of surface, large tuyères with only moderate pressure being preferred as air rather than heat is wanted to drive off sulphur.

When the molten regulus begins to enter the desulphurating furnace the blast is put on, and it is increased to the required strength as the contents rise to a level with the skimming plate, the level being maintained by running in molten regulus as the slag is drawn off. When the contents contain 85 or 90 p. c. of metallic copper, they are run off into sand beds or iron moulds.

A reducing and desulphurizing furnace might be employed with three tap-holes and five rabble doors, and with a receptacle in the bottom for collecting any precious metals present in the ores. Different engines and pressures of blast might be used for two tiers of tuyères. Steam as well as air might be used, the steam cooling the furnace when becoming too hot, and driving off sulphur. The metal or metals could be brought to a high state of purity in this furnace, but would be preferably run into moulds, and the different metals would be separated from each other and afterwards refined ; or the metal might be run at once into a refining-furnace.

[*Drawing.*]

A.D. 1881, August 3.—No. 3353.

LAMBERTON, ANDREW.—Crushing and pulverizing machine.

Mineral or metallic substances, including stones, phosphates, and pyrites, may be treated in a machine comprising a strong

framing, in the upper part of which there may be one stationary crushing-jaw and two jaws carried on an axis, whereon they can be moved upwards and downwards as well as inwards and outwards by eccentrics on a shaft, passing through adjustable bearings in the framing, and carrying a flywheel and driving-pulley. As each movable jaw is forced upwards and inwards, it crushes the material fed into the machine against the fixed jaw, and the crushed material falls down through a guide into the space between two cylindrical rollers ; which are adjustably located close or nearly close together in the lower part of the framing, and are rotated in opposite directions and preferably at different speeds by a train of spur-wheels connecting the above-mentioned shaft to the axes of the rollers. Thus the material is further crushed or pulverized. The number of movable jaws may be varied, as may the number of pairs of rollers employed. To prevent the surfaces of the rollers being "corded," grooved, or otherwise cut into by revolving constantly in one plane, a lengthwise or reciprocating motion may be imparted to one or more of them. For this purpose one end of a lever, which is centred on a pin, is connected to one end of the axis of the roller intended to reciprocate. The other end of the lever contains a slot, through which passes a pin fixed in a worm wheel. The latter is carried by a bracket on the framing, and is geared with a worm screw on the end of a horizontal shaft, likewise carried, and connected by a belt and pulleys to the above-mentioned shaft.

[*Drawing.*]

A.D. 1881, August 9.—No. 3443.

ABEL, Charles Denton.—(*A communication from Heinrich Precht.*)—Treating the gases of furnaces and calcining-kilns.

The sulphurous acid in the gases may be powerfully absorbed by hydrate or carbonate of magnesia or hydrate of alumina, or a mixture thereof ; the resulting sulphite at a red heat is chiefly reconverted into pure sulphurous acid (which can be used in making sulphuric acid) and magnesia or alumina, which is thus regenerated for use again. When carbonate of magnesia is used, the carbonic acid is driven off while the sulphurous acid is absorbed. Hydrate of magnesia, when employed, is either

moistened with water and spread on hurdles in chambers, towers, or other apparatus, through which the gases pass ; or is brought in contact with the gases in the form of milk of magnesia within receptacles provided with stirring-apparatus. The gases may first come in contact with more or less saturated, and afterwards with fresh, magnesia. With milk of magnesia, the sulphite is obtained as an almost insoluble crystalline deposit: while a little sulphate, also formed, remains in the solution ; which can be utilized by itself or used for moistening the regenerated magnesia. The sulphate of magnesia formed during the absorption of the sulphurous acid, and during the heating of the sulphite, can also be treated to obtain magnesia and sulphurous acid by heating it to redness with charcoal powder (carbonic acid being then also evolved) ; or by heating it in a current of hydrogen sulphide or of the vapour of sulphur, or in a current of hydrogen or a hydrocarbon, or with other volatile or solid reducing agent.

The gases for treatment should be first cooled to about 100° Cent., and are preferably freed as much as possible from sulphuric acid and used moist. They may be cooled in metal pipes exposed to the air, or by spraying water into them in chambers placed in the flue, or by passing them over water, which can be agitated to promote evaporation and cooling: this water may be mixed with finely-powdered magnesia to take part in the absorption.

[*No Drawings.*]

A.D. 1881, August 16.—No. 3566.

ANDERSON, James Colwell.—Reducing or pulverizing machine.

A shell, formed of cast steel when hard substances (including felspathic, granitic, and quartz rock) are to be treated, comprises two vertical cylinders with their contiguous sides cut away, so that, as shown in a drawing, they enclose a single space, which in horizontal section corresponds to that enclosed by two slightly overlapping circles. This double cylindrical shell terminates at the bottom in a flange, which serves as a base-plate, and beneath which is an oblong inverted hollow cone forming the bottom of the shell and constituting a funnel-like passage to a discharge opening. The cylinders are covered by two hemispherical domes joined side to side, the

different parts of the shell being fitted snugly together at their flange edges and secured by screw bolts. Each cylinder contains a central vertical shaft. The two shafts have bearings beneath the shell, sleeves being formed in the bottom of the shell for the bearings and (in conjunction with collars on the shafts) to protect the bearings from dust. The bearings are secured to the shell, and have shoes and oil reservoirs to protect the journals at the high speed required. The shafts have upper journal bearings in boxes, which are formed on the hemispherical domes, and are "babbited" and provided with movable caps. Inner cylinders are keyed upon the shafts. A series of arms or projections are formed as a part of these cylinders and likewise of the cylinders of the shell, the arms projecting outwardly from the former and inwardly from the latter cylinders. The arms of the different cylinders overlap each other, and their ends come nearly close to the opposite cylinders. They are so arranged or spaced as to alternate with each other, and to prevent clashing together when the inner cylinders are rotated by belts in connection with pulleys on the upper ends of the shafts. The arms are set in horizontal rows ; but are battered out of a vertical plane from the working side of the arms, so that the longitudinal rows of the arms converge towards each other downwards in such manner as to intersect and cross each other in the pulverizing operation, which, to reduce hard substances to fine powder, may require a speed of even 2,300 revolutions per minute. The materials for treatment are shovelled into a chute provided in connection with a pediment or extension, which is formed on the side of the domes, and surrounds a hinged metallic door. This door only opens when the materials press against it, and undue escape of dust is prevented. The chute is also adjustable, being hinged or pivoted at one end to the shell, and being supported at the other by a brace, which is hinged to the outer end of the chute, and may be supported in any one of a set of graduated notches (shown in a drawing as formed in a projection on the shell). A slow and regular feed is thus secured. The horizontal rotation of the inner armed cylinders causes the descending materials to take the direction of such rotation, in conjunction with the action of gravity which tends downwards; thus numerous spiral currents are formed. These currents, produced by the high "peripherical" speed of the said

cylinders moving in opposite directions, come into violent collision with each other at the intersecting point of the two cylinders and disintegrate each other, while less violent contact takes place upon the materials by the outward thrust of the centrifugal force from the rotating cylinders and the inward curbing centripetal impact of the surrounding shell and the further attrition force due to the interlacing of the stationary and rotating arms. The cohesion of the materials is also destroyed by the explosive force generated by rapid rotation and the alternate vacuum and air currents produced by the mechanism.

[*Drawing.*]

A.D. 1881, August 17.—No. 3584.

CLARK, William.—(*A communication from Charles Girard and J. A. Pabst.*)—Production of arsenic and other substances.

The crystals (sulphate of nitrosyl), formed in the lead chambers used in making sulphuric acid, may be employed for decomposing combinations of hydrogen with the metalloids, including "arseniated," sulphuretted, and phosphoretted hydrogen, which are caused to pass through a sulphuric acid solution containing sulphate of nitrosyl, or through a column of coke, charcoal, or fragments of porous earthenware or brick saturated with nitro-sulphuric acid, whereby they become decomposed, arsenic or the metalloid present being deposited. Thus arsenic may be manufactured.

[*No Drawings.*]

A.D. 1881, August 20.—No. 3641.

LONES, Jabez, VERNON, Charles, HOLDEN, Edward, and BENNETT, Ralph.—(*Provisional protection only.*)—Puddling and mill furnaces.

In addition to the ordinary horizontal firebars, the fireplace has inclined bars in the lower half of the front of the furnace. Air, entering the fireplace from the hollow bridge of a puddling-furnace, passes through openings in the front of the bridge. The sides and arched top of the fireplace are hollow. Cold air entering from the ashpit is heated as it ascends in the hollow sides of the fireplace, and, mingling with heated air entering from the hollow sides and from under the bottom of the puddling-chamber, enters the fireplace through openings in the

arched top. The heated air burns the volatile combustible products from the heated fuel, the solid part of which is burnt mainly by air entering through the bars and bridge. In mill furnaces the arrangement is modified. Slack may be the fuel employed.

[*No Drawings.*]

A.D. 1881, August 22.—No. 3646.

HADDAN, Herbert John.—(*A communication from Alexis Drouin.*)—Wet extraction of lead, silver, copper, nickel, and cobalt from ores and matts.

The process consists in binding with chlorine and at a low temperature the metals in the ores etc., an acidulated solution of a soluble chloride being used. The ores, ground to a fine powder, may be treated in wooden vessels with a double bottom, serving as a filter, the liquid employed, which is supplied from a reservoir above, generally containing from 20 to 25 p. c of salt and 1 to 10 of (hydrochloric or sulphuric) acid. If the ore contains lead, it is treated hot : the mixture of ore and liquid may be heated by steam to about 80° or 90° Cent. When neither lead nor silver is present, heat is not employed. From the solutions thus obtained of the metals as chlorides, different metals may be precipitated cold and hot. It will suffice to cool down the solution of lead, the silver having been previously removed. The chloride of lead produces small cystals easily collected. Copper is precipitated after cooling by means of metallic iron. The solution containing nickel or cobalt, after removing the copper, is submitted to a current of chlorine for peroxidizing the metallic salts ; the iron is then precipitated by carbonate of lime. The nickel and cobalt are precipitated as oxides from the filtered liquid by lime water, and then separated by known means. The use of chlorine for precipitating copper, nickel, and cobalt may be dispensed with by using an alkaline sulphide. To remove iron, this mixture of sulphides is acted on by dilute hydrochloric acid, whereby chloride of iron is formed, which may be used like chloride of sodium for dissolving metals under the above conditions. The sulphides of nickel and cobalt are then roasted to obtain pure oxides.

The precipitated metals must be rapidly and abundantly

washed to remove salts. They are then dried cold ; an hydraulic press or drying apparatus may be used. Silver is cast in crucibles and the other metals in a reverberatory furnace. The metal may be extracted from the chloride of lead by casting with coal and carbonate of lime. The same dissolving-liquid, after the precipitation of the metals, may be used repeatedly

The ground ores must be sometimes roasted prior to the wet treatment if they contain copper, nickel, or cobalt, but at a low temperature and in a very oxidizing atmosphere. For extracting lead, roasting is not needed.

By this process metals may be extracted from the residues (too poor for foundry use) of the mechanical treatment of ores.

[*No Drawings.*]

A.D. 1881, August 22.—No. 3653.

READWIN, Thomas Allison.—Ore-grinding and amalgamating machines.

In machines having a pestle, rotating about its own axis, and rolling obliquely on the interior of a circular pan ; the vertical spindle, which carries a hooked arm to actuate the axis of the pestle, may have bearings of hard wood, prepared asbestos, or other material which wears well when lubricated with water, the lubricant being supplied through holes in the boss of a bevel wheel, shown in a drawing as fixed on the top of the spindle and receiving motion from a horizontal driving-shaft. The axis of the pestle is made of hardened steel or phosphor bronze, and is so fixed in the body of the pestle (by keys or screws) that it can be shifted lengthwise to compensate for wear or renewed at pleasure. The bottom of the pan is recessed to receive a hardened steel or phosphor bronze cup, in which works the lower end of the said axis, and which holds the mercury for amalgamation. An eyed tap screw is screwed into the bottom of the pan to allow, when unscrewed, of the mercury or amalgam being run off from the cup, through which a corresponding hole is bored and tapped to permit of easy removal by a ring bolt. A wire or bar (which may consist of stranded wires) is passed through the eye of the screw and secured by a lock and key to prevent unauthorized withdrawal of the contents of the pan.

The machine may comprise, say, ten pans and their adjuncts. From a hopper, suitably-crushed ore is supplied through a shoot with an adjustable regulating-tube to a long trough above the pans. A screw-biaded shaft revolves within and carries the ore along the trough, so that it passes in a uniform layer over adjustable apertures in the bottom of the trough; a regulated quantity of ore thus falls through into spouts leading to the different pans. The said apertures have sliding shutters, and the screw shaft and pestles are shown as driven together so that the screw and pestles revolve at proportionate rates. The feed can be otherwise regulated; thus, each aperture in the trough may be provided with a chamber of specific capacity, having inlets and outlets to be operated at regular intervals by screws or gearing, or a boss on the screw shaft may carry a cup, dipping into the ore and discharging the required quantity into a shoot in a specified time. Disconnecting-levers are shown as applied to the gearing of the different spindles. The cups are filled with mercury (specially prepared, if required); and water is run into the pans from supply pipes up to the level of overflow pipes. By the crushing and grinding action of the pestles on the pans the ore is pulverized, and is then presented to the mercury; which forms an amalgam with the amalgamable portion of the precious metals present. During the process the water continually overflows together with the baser metals and gangue.

[*Drawing.*]

A.D. 1881, August 25.—No. 3704.

STUART, John Medley.—Crushing gold ore and effecting amalgams.

The apparatus has an outer case, within which is supported a (preferably chilled steel) false bottom, fixed to a central axis revolving in bearings. Around this axis there is a hollow axis with arms forming axes, which are inclined to receive a set of conical rollers. The number or size of the latter is such that the surface of each can act with those adjoining; while their surfaces which for the time are the lowest rest on the false bottom or plate. By means of pinions in gear with a driving-pinion, the central and hollow axes are made to revolve in opposite directions. The ore for treatment falls upon the

rollers and is crushed by the action of their surfaces, and is further crushed between their lower surfaces and the surface of the revolving plate. The outer ends of the rollers also operate with the side of the outer case for crushing. Water is supplied with the ore to aid the action of the surfaces ; it may enter by a channel through the bottom of the case to flow out at the upper part thereof. For effecting amalgams, small quantities of mercury are dropped in upon the ore at intervals ; the amalgam may be extracted by an opening in the bottom of the case. The ore, when sufficiently crushed, overflows through a grating.

The arrangements may be varied. A central axis or shaft may carry the rollers, and a surrounding hollow shaft the false bottom. Arms near the upper end of the central shaft may, by straps at their outer ends, be connected to the outer ends of the axes of the rollers to actuate them ; the inner ends of the roller axes being connected by pin joints to lugs on a collar or ring, which may simply surround and move freely on the central shaft or be fixed to move therewith. The said arms and straps will guide the ore to between the rollers. Sometimes, as for crushing only the false bottom may be stationary and be formed with, say, three inclines and depressions, the rollers rising up the inclines and then falling with greater force on the ore in the depressions ; two rollers are here generally employed.

[*Drawings.*]

A.D. 1881, August 26.—No. 3732.

CLARK, Alexander Melville.—(*A communication from Alfred Michaud.*) — (*Provisional protection only.*)—Production of printing-surfaces.

A fusible alloy of bismuth, tin, lead, and mercury is employed in casting impressions of photo reliefs.

[*Drawings.*]

A.D. 1881, August 30.—No. 3772.

GUTENSOHN, Adolf.—Removing tin from the surface of tin plate.

The tin plate, in fragments or cuttings, is placed with sharp

sand, emery, glass, or other abrasive powder in a wrought-iron, cast-iron, or other strong and refractory cylinder, which is made to revolve horizontally or nearly so above a fire. Thus the metallic tin is melted, and is thoroughly removed from the surface of the iron beneath by the scouring action of the abrasive powder with which it becomes mixed. Afterwards the contents of the cylinder are removed. By repeating the process the abrasive powder gradually becomes rich enough in metallic tin for its separation, for instance, by agitation upon a heated plate, whereon the tin collects in large globules and may be subsequently separated from the powder by sifting. Any remaining tin may be dissolved by an acid solution. Sometimes there may be added to the contents of the cylinder " a sub- " stance capable of chemically combining with the tin, such as " chloride of lime, or a phosphate of lime or alumina, together " with " water. In this case heating is not essential ; the tin being removed " in combination with the salt, from which it can " afterwards be precipitated " as usual.

One or both ends of the cylinder may be movable or have a charging door, and each end may have a central axis revolving in bearings. The ends of the cylinder should fit pretty closely against the masonry of the furnace to avoid loss of heat. Hollow axes will allow steam or vapour to escape. Again, external flanges on one or both ends of the cylinder may revolve upon friction rollers. Also the heating may be effected by introducing a blast of sufficiently hot air or gas into the cylinder ; and a vessel of other shape can be used, which may oscillate or otherwise move to agitate its contents.

[*Drawing.*]

A.D. 1881, August 31.—No. 3785.

ALEXANDER, John, and McCOSH, Andrew Kirkwood.—Separating matters from combustible furnace gases.

Referring to the inventors' prior Specifications No. 4117, A.D. 1879, and No. 1433, A.D. 1880, the gases from blast furnaces are first led into condensing or separating apparatus of the kind to which the secondly-mentioned prior Specification relates. One improvement consists in making the apparatus principally of wrought iron instead of cast iron ; also, " in connecting the

" water boxes in the interior of the apparatus, the pipes are led " from the tops of the lower boxes to the highest parts of the " upper boxes, instead of the connections with the latter being " lower down," to " prevent heated water from remaining in " the tops of the upper boxes and not passing along in the " general current."

From this apparatus the gases pass into scrubbers or washing-towers, which are made rectangular in plan instead of circular, and the gases in ascending therethrough pass in a broad uniform stream alternately from side to side between inclined perforated diaphragms, spaces of the full width being left at alternate opposite sides. By successively disconnecting each tower from the gas pipes by valves and admitting a large volume of steam into it, the heating effect thereof renders the tarry matters thinner and less adhesive whilst the condensed water washes the matters down, so that the diaphragms, which are made of metal instead of wood, are cleaned. For introducing cleaning-instruments doors are provided, which also act as safety or explosion valves. Water is admitted through a perforated pipe so as to be equally distributed over the top diaphragm. In a modified arrangement, the gases are led through a series of vertical cylinders connected alternately at top and bottom. To cool the gases and separate tarry and other matters therefrom, showers of water are introduced into the tops of the alternate cylinders, in which the gases descend, or into all the cylinders, in which case fans may impart movement to the gases. Tarry and soluble matters are drawn off through trapped outlets at the base of the cylinders. In inclined or horizontal cylinders, the showers of water descend obliquely or at right angles to the flow of the gases. In another modification, the gases pass alternately up and down through numerous tubes placed vertically in a casing, partitions in top and bottom spaces in the casing leading the gases from one to another section of the tubes. Cold water or air may circulate outside the tubes. Small openings with plugs or covers are provided in the top of the casing opposite the several tubes, and, by removing the plugs in succession, an instrument can be introduced to clean the insides of the tubes from tarry and other matters without stopping the general action of the apparatus.

[*Drawings.*]

A.D. 1881, August 31.—No. 3792.

SIEMENS, Charles William.—Furnaces.

Reference is made to the prior Specification No. 3374, A.D. 1880.

In the case of an open-hearth regenerative gas steel-melting furnace, to check the destructive action of scoria upon the sides of the bed or lining of the melting-chamber, the inventor adds " thereto pipes for circulating water around and cooling " the upper part of the bed without cooling the furnace " elsewhere. The pipes may be placed in recesses behind the sloping sides and ends of the bed. All joints are preferably outside the furnace, inverted U junctions providing for expansion and contraction of the pipes.

Metal may be melted in a furnace, the bed or floor of which is steeply inclined, and terminates in a receiving-basin with a tapping-hole. The bed should be of a basic character, to react on cast iron which may be melted and purified thereon. There are flame ports at the basin or lower end of the bed, and the chimney is at the higher end. The crown of the furnace has a double arch with an intermediate space, forming a passage for air, and furnished with bafflers which may be tie bricks uniting and strengthening the two arches. The air, traversing conduits in the chimney flue and the said passage, becomes highly heated and, at the flame ports, meets gas from a gas producer. Sometimes steam jets or a blast of air may be used at the ends of the said conduits or elsewhere in the air course. To prevent air leaking into the furnace chamber from the said passage, the lower arch may be coated with a wash or thin layer of lime, soda, or other alkaline substance, which will flux with the bricks and cement of the joints to form a surface enamel or glaze ; or basic silicates may be used. An impermeable glaze may be likewise produced on those parts of regenerative furnaces generally, which transmit heat by conduction from and to currents circulating on opposite sides of brick partitions ; as in regenerators operating in accordance with the prior Specification : thin glazed brick partitions may replace the metal plate partitions, and tie bricks forming bafflers may also be employed.

Referring to the prior Specification, gas producers may be employed having (instead of a central inlet tube) air supply pipes, projecting through the lower sloping part of the producer at several points, and directing the air obliquely upwards

towards the heart of the fuel. Coils of these pipes may lie in an annular space, where the gas produced collects on its way to the furnace, so as to cool the gas and heat the air. Again, in dispensing with a forced air supply to the circular form of gas producer, the lower part of the sloping or conical bottom may be constructed as an open grate, formed of bent bars, which may be supported by rings, or hooked at their upper ends on to a circular support. A screen with doors may regulate the admission of air. A central air or steam jet may be also used, this air being heated in a casing (with pockets) at the top of the gas collecting space. A metal, instead of a brick, partition may separate the incoming fuel from the gas produced. Water may be admitted to these gas producers by a circular perforated pipe (or otherwise), so as to cool the bars and hot cinders and supply aqueous vapour to aid in decomposing the incandescent fuel. Sometimes the air employed is not previously heated, and the producers may be of other forms, instead of circular in plan.

[*Drawings.*]

A.D. 1881, August 31.—No. 3793.

MILLS, Benjamin Joseph Barnard.—(*A communication from John Joseph Charles Smith and Hermann Gelpcke.*)—Alloy.

An alloy containing sixty-six parts of lead, thirty of tin, and four parts of antimony is used in the manufacture of dies or moulds, to be employed in connection with the production of vulcanized india-rubber articles.

[*Drawings.*]

A.D. 1881, September 13.—No. 3951.

POPE, Samuel.—Regenerative furnaces.

In these gas furnaces for metallurgical and other purposes, there may be applied independent connecting flues between the draught flue leading to the chimney (or any substitute therefor) and the regenerative chambers, for the purpose of regulating the quantity of gases, smoke, and other products of combustion passing through these chambers. One or more independent flues, containing regulating-valves or dampers, are constructed between the regenerative chambers or their outlets

and the draught flue. This arrangement obviates the inconvenience arising from the liability of the chambers, as generally constructed, to fail in passing through them their due share of the products of combustion, thereby causing loss of heat to the incoming air or gases and overheating of the brickwork. Increased durability of the furnace is obtained, also facility to regulate the temperature and processes within it and to increase the intensity of the heat, economy in working, cooling, and starting being favoured.

[*Drawing.*]

A.D. 1881, September 16.—No. 4002.

HADDAN, HERBERT JOHN.—(*A communication from Joseph Chaine.*)—(*Provisional protection not allowed.*)—"Improvements "in the manufacture of cast iron, also applicable to the pro-"duction of other metals from their ores."

The invention is described with reference to making pig-iron in a blast furnace. To obtain "a more uniform repartition and "constant proportion" of the materials employed, the ores, fluxes, and fuel are applied in a pulverulent state and transformed into pieces or agglomerates of uniform size, which are dried and heated before their introduction into the blast furnace. Inferior ores and fuel (such as peat) may be thus utilized.

[*No Drawings.*]

A.D. 1881, September 17.—No. 4007.

WHITE, GEORGE.—Ladles for molten metal.

A wheelbarrow, for carrying and pouring out solid substances and liquids, is described. Its body is preferably somewhat like the longitudinal section of a horn, with the narrow part placed near the side of the wheel to form the spout, and the wider part toward the handles, it being preferred to pour only on one side of the wheel. The periphery of the wheel represents the "frustum of an ellipsis, with its larger diameter in a line with "the centre of the barrow, and its smaller diameters towards "the sides." Normally the wheel will roll on its larger diameter, but, when the barrow is tipped several degrees on one side, on its smaller diameter : thus there is but little tendency to turn over. When required for liquids, the body of the barrow is

adapted to hold them ; or its frame may carry separate pots or ladles. For conveying and pouring out fused metal, a curved foot is provided on one or both sides of the barrow, so that in pouring, when the centre of gravity gets beyond the edge of the wheel, the foot arrests it and takes the weight, thus enabling the workman to empty the ladle. For very large ladles, the hand-truck form of handle is adopted so that several may assist in the work.

[*No Drawings.*]

A.D. 1881, September 26.—No. 4139.

WEBB, Thomas Stammers.—Coating metals.

Preparation and application of materials for coating and preserving metallic and other surfaces.

A finely-powdered mixture of red oxide of lead, boracic acid, calcined flint, and borax, or of the first three of these, or of red oxide of lead, boracic acid, flint glass, and carbonate of soda, or of red oxide of lead, borate of lead, and calcined flint in various proportions, is fused, powdered, and ground to a thin cream with water or paraffin oil. Metallic oxides may be added, for example protoxide of cobalt, and protoxide of lead. Minium or lead carbonate may be used instead of the protoxide of lead.

The articles to be treated are cleaned from scale by being immersed in weak muriatic acid, brushed in water with a wire brush, placed in an alkaline bath, and washed with warm water.

The preservative materials may be applied by a brush but it is preferable to immerse the articles in a bath of the material in a vessel constructed so that pressure may be applied to its contents. When the articles are removed they are brushed to remove excess of material, dried and raised to a high temperature in a muffle or oven, and then cooled. The vitreous surfaces thus obtained may be wholly or partially coated with gold, silver or platina by applying one or more coatings of solutions of these metals and then heating to incipient redness. The substances described may be used as vehicles for applying colouring matters such as the oxides of iron, chromium and uranium or refractory and opaque bodies such as calcined flint, and the sulphates of lime and baryta. These are added as fine powders to the ground-up substances. The Provisional Specification

also states that a metallic lustre may be given to the articles treated by adding platinum chloride, platinum black, or spongy platinum to the preservative coating before applying it.

[*No Drawings.*]

A.D. 1881, September 26.—No. 4149.

GETCHELL, Annie.—(*Provisional protection only.*)—Treating copper to produce a new metal or alloy.

To every 25 lbs. of copper, heated to redness in a crucible or furnace, there are added about $1\frac{1}{2}$ lb. of potash or soda, 1 of alum, $\frac{1}{4}$ of bone dust or other phosphate, and $\frac{1}{4}$ of zinc or tin. After the mixture of copper with this composition is melted, the slag is removed, and the metal (preferably covered with charcoal to prevent oxidation) may be run into moulds. The metal thus produced is specially useful for bearings in machinery and for other purposes, for which a metal having the qualities of hardness, density, toughness, and lubricity (smoothness-like oiliness), is desirable.

[*No Drawings.*]

A.D. 1881, September 28.—No. 4183.

STONE, Robert.—Bricks for lining furnaces etc.

Reference is made to Specifications No. 3605, A.D. 1878, No. 2535, A.D. 1879, No. 2070, A.D. 1880, and No. 2171, A.D. 1881.

Refractory bricks are made from river mud, sometimes mixed with ground lime, hot waste chalk, or roasted sand.

The mud, direct from the river bed, is run between corrugated rolls or through other suitable machinery ; or a mill having a vertical cone revolving upon or within a vertical cylinder, and with an archimedean screw feed, may be used. The plastic material is forced through dies, preferably of polished plate glass, by a ram worked by cams or screws, and is forced by means of a cam, lever, or screw between glass side guides and against slanting knives or wires to a band or boards. After a first burning the bricks &c. are cooled down and then reburnt at a much higher temperature until vitrified.

[*No Drawings.*]

A.D. 1881, September 29.—No. 4198.

LAKE, William Robert.—(*A communication from Hermann Reusch.*)—(*Letters Patent void for want of final Specification.*)—Steel-faced armour plates.

To check the formation of cracks, while allowing the use of very hard and resistant steel, the steel-faced plate at any stage of the rolling operations may be heated to redness for several days in an annealing-furnace ; the steel face being well covered with a material containing oxygen and having a decarburizing action, such as pure oxide of iron.

[*No Drawings.*]

A.D. 1881, September 30.—No. 4218.

FRANCIS, John Richardson.—(*A communication from Henry Wurtz.*)—Treating mineral pyrites and sulphurets for obtaining sulphuric acid and metals.

"The consolidation of all varieties of granular sulphurets into "cakes, lumps, or blocks," prior to desulphurization or burning in a pyrites kiln, may be effected by "mixing therewith metallic "iron in comminuted or divided form, and causing this iron to "rust and form hydrated oxide or a basic salt in the interstices "of the mass by admixture with a saline solution." The sulphurets are crushed when needful, and the gangue and impurities can be removed by a current of air or water or otherwise, so that purified granules are obtained for treatment. The rusting and cementing action of the metallic iron is accelerated and intensified by alternately moistening the mixture with water and drying either spontaneously or by a gentle heat. Fibrous and foliated mineral substances, such as asbestos and mica, may be incorporated with the mixture to add to the cohesion of the mass and prevent its crumbling. The metallic iron preferred is iron sponge or comminuted iron resulting from the (at least approximately complete) deoxidation of pulverized iron oxides or ores by carbon or deoxidizing-gases at temperatures too low to weld the granules of reduced metal together. The cinder or residue resulting from the burning of the said cakes (prepared from purified iron pyrites) is itself well suited for making the iron sponge. It is generally desirable that the metallic iron employed should be free from such impurities as would contaminate the residue for special uses.

Thus, if amalgamation or chlorination is to be applied to the residue for extracting gold, the iron should be put through a magnetic separator to eliminate all lead, zinc, copper, and brass, with non-metallic impurities. If copper is to be extracted from the residue, the presence of copper and brass in the iron may be neglected. If grease be present, the iron should be lixiviated with dilute caustic soda or petroleum-naphtha. Sulphate of iron is preferred for the saline solution, but some other sulphates, including those of magnesia, alumina, potash, and ammonia, can be used: deliquescent, efflorescent, and acid agents and chlorides should be avoided.

Fine and coarse sorts of purified granules should be mixed together and with the sponge or other granular iron and the saline solution, and asbestos or mica if used, in a heated state. The solid materials, after being heated by the passage through them of hot air, may be introduced into a mixing box or vat with a stream of the boiling hot saline solution. The completed mixture, having about the consistence of thick mortar, may be spread in a thin layer upon sheet lead, the cake thus produced being (after hardening) broken by hand into pieces for the kiln, or divided (while soft) by an inverted mould with knife-edged septa. Means are provided for applying a temperature of from 120° to 150° Fahr. by air or steam, and for sprinkling a fine spray of water over the mixture.

The porous solid cakes thus produced kindle readily in the kiln and propagate their own combustion, which is more rapid and complete than with compact lump pyrites, while less attendance is required. Also the porous residue, containing less than 1 p. c. of sulphur, is better suited than dust and mud for the extraction of copper, silver, and gold by solvents.

[*No Drawings.*]

A.D. 1881, October 5.—No. 4328.

WHITING, Mary Matilda.—Phosphor alloys.

The invention relates to wire and other metal work, and, with reference to the preparation of wire for various applications, the following process is described:—Thick phosphor brass or bronze wire is immersed in a bath of from 0.125 to 5 p. c. of phosphorus, with 5 p. c. of sulphuric acid and 95 p. c. of water. It is then drawn down one gauge thinner. It is now

placed in an open pot having a thin layer of phosphorus at the bottom ; it is then bedded in charcoal which is ignited and left burning for several hours ; the heat softens the wire and makes it ready for drawing again. By alternating these processes the wire can be drawn down to any gauge required. This process phosphorizes the metal and produces the quality of metal called phosphorized by the inventor. It is stated that phosphor and phosphorized bronze and brass will neither rust nor corrode, are stronger than iron or steel and more durable than copper, and can be rolled and drawn as soft as lead or as hard as steel. The applications of the wire and metal work include for making screens, riddles, dressers, and agitators for minerals.

[*No Drawings.*]

A.D. 1881, October 8.—No. 4384.

THOMAS, SIDNEY GILCHRIST.—Manufacture of basic bricks.

To produce hard, durable, and refractory magnesian bricks, the inventor burns magnesia or carbonate or hydrate of magnesia (" which latter may be obtained by reprecipitating by magnesian " lime magnesia from a solution of dolomite in hydrochloric " acid " or in some other way) in rough bricks or blocks at a very intense white heat in lime-lined cupolas or kilns, but preferably in regenerative or continuous gas kilns with a down draught, so as to produce an intensely-shrunk material. This shrunk magnesia is then ground with water, tar, or crude hydrocarbon oils, and sometimes with not more than 20 p. c. of coke dust or plumbago, to form a plastic mass, which is made into bricks preferably using considerable pressure. It is preferred, after drying the bricks, that they should be again fired at a full white heat. The magnesia employed should not contain more than 5 p. c. of silica ; if it contains less, it may sometimes be mixed with enough clay to give it about 5 p. c. of silica and 2 or 3 of alumina and oxide of iron.

To avoid the inconvenience and loss resulting from the great shrinkage of lime bricks while being fired in kilns, bricks of the shrunk magnesia may be " inserted as binding courses in the " kiln between every sixth or seventh row in height of the " lime bricks." Thus, the great shrinkage of the latter is counteracted by the non-shrinkage of the former, and the lime

bricks may be piled twenty or thirty courses high instead of eight or ten, which economizes fuel.

[*No Drawings.*]

A.D. 1881, October 11.—No. 4418.

MACKENZIE, Robert.—Calcining sulphide ores of copper and other metals.

This continuous roasting process, which saves time and labour, is effected in a closed furnace, say, of brickwork or masonry, preferably strengthened by exterior bands or casing, and somewhat contracted about the middle of its height. There is a feeding hopper at the top of the furnace, and the roasted ore is withdrawn at the bottom by inclined lateral shoots furnished with doors. Steam is passed through the ore while roasting; it may be introduced by a pipe at the bottom of the furnace, or water may trickle over inclined surfaces at the bottom. But there is preferably placed on the bed of the furnace a shallow water tank, part of which may be occupied by a pyramid of open brickwork. The steam generated by the heat of the roasting ore rises through the body of ore and hastens the roasting process. The fumes from the ore are conveyed from the upper part of the furnace by a lateral flue to a condenser. Thus, they may be passed into the top of one or two vertical shafts or towers, wherein a shower of water will descend with the fumes, which are finally drawn through water at the bottom by an ejector or exhauster. Sometimes water may be discharged upon the ore at the upper part of the furnace. The said tank is supplied with water in excess; the hot overflowing water (charged with products from the calcined ore) and the water from the bottoms of the towers may be used to moisten heaps of ore for lixiviation, and also in the precipitating tanks to economize the consumption of iron therein. Again, the fumes may be used in making sulphuric acid. Volatilizable metals, present in the ore, pass off with the fumes and become condensed in the towers.

[*Drawing.*]

A.D. 1881, October 11.—No. 4435.

CHENHALL, James Warne.—Furnaces for lead smelting.

A low-level, gas-producing fire-place may be adapted to the working beds of reverberatory furnaces (such as the Flintshire, flowing, and Spanish furnaces) used in calcining and reducing

lead ores. An upright shaft conveys the gases from the fireplace (placed much lower than the bed) to the furnace. The firebars may be 20 feet below the bridge. Coal is supplied to to the fireplace through a hopper having doors to avoid free access of air. Only sufficient air for partial combustion is passed through the fireplace. Abreast or at the back of the latter and the gas flue therefrom, there is another flue (or flues) to convey air ; the upper exit of which should be near the bridge. Doors, at the bottom of the air flue and at the ash-pit, regulate the passage of air. The regularity of combustion obtained saves fuel, and an oxidizing or reducing flame can be produced in the furnace at will. The upward pressure of the gas from the fireplace and the air obviates the need for a strong chimney draught : a moderate draught, sufficient to take away the product of combustion, suffices. Hence but a small amount of lead fume is produced, and its condensation in chambers, flues, etc. is also facilitated.

[*Drawing.*]

A.D. 1881, October 12.—No. 4444.

LAKE, Henry Harris.—(*A communication from Hermann Reusch.*)—Coating metals.

Relates to coating iron or steel with metals or alloys tensile at a red heat. The plate or other article is freed from oxides and other impurities and coated with a thin film of tin or with an easily fusible alloy thereof, preferably in the form of foil and then placed in the coating-metal. The plate is afterwards heated to redness, and reduced to the required thickness, by rolling between smooth well cooled rollers.

The coating is effected better when the cleaned surface is covered or sprinkled over with a solution or powder of chloride of zinc, sal ammoniac, or other metal chloride which will volatilize at a red heat.

The process may be used to unite metals or alloys which are tensile at a red heat as for instance when coating or plating copper with silver.

[*No Drawings.*]

A.D. 1881, October 13.—No. 4456.

BLACK, William, and LARKIN, Thomas.—Furnaces for calcining and decomposing copper ores.

Reference is made to the prior Specification No. 4468, A.D. 1880, which includes the use of blades, paddles, or pallets, and stirrers, or revolving arms, for manipulating and discharging certain substances on a calcining bed.

According to the present invention, a furnace may have one or more beds or calcining floors, arranged one above another. After the ore (small or fine ore, in particular) has been dried on the top of the furnace, it is charged upon the top bed, and is then worked down to a lower bed, and so on, until it reaches the final heat on the bottom bed. Or the ore may be charged to each bed separately; the process may be begun or finished at any required bed. The gases or products given off by the ore may be carried from the lower over or through the upper beds, or be otherwise conveyed away to be utilized (say, to a sulphuric-acid chamber); provision is made for collecting condensed sulphur (the invention including the extraction of sulphur from ores). Heat is applied to the under side of the bottom bed from flues leading from fireplaces, the flues being either returned or carried on to the chimney. Heat for the other beds is obtained by the calcination of the ore on the bed or beds below.

A furnace described has three chambers and beds for treating the ore, with bed plates and roof plate supported in the outer walls. Each chamber has a door, and the bottom chamber also a discharging-door. A valved charging hopper opens into the upper chamber. A rotating shaft, mounted in bearings and passing through a gas-tight opening at the roof plate, carries a set of arms for each chamber, the arms having scrapers or stirrers, preferably such as the prior Specification relates to. Each of the upper bed plates has slots or openings, fitted with sliding shutters, and preferably arranged at various distances from the centre of the beds. Thus the ore is agitated on the top bed, and is discharged by the slots on to the bed below; where it is further treated at a higher temperature, and thence passes to the bottom bed for final treatment and removal. Holes may be provided to admit air to each chamber. Hollow bearers for beds and roof plate may be traversed by cold air The floors of the beds are preferably of iron, fire-clay, or quartz.

In place of, or in addition to, rotating the shaft, the bed plates may be rotated.

[*Drawing.*]

A.D. 1881, October 14.—No. 4486.

READMAN, James Burgess.—Obtaining nickel and cobalt.

Ores, more especially those containing nickel, cobalt, and manganese, either as oxides or combined with silica, after being finely powdered, are mixed with sulphate of sodium either anhydrous or in the form of Glauber's salt, using the proportion of about 80 parts by weight of anhydrous sulphate to 100 of ore, and with enough sulphuric acid to convert the sulphate into bisulphate. After drying, the mixture is fused and then stirred with a bar or rake to promote the escape of gaseous sulphuric acid and water vapour. When testing shows that the cobalt, nickel, and manganese have become soluble, the mass is stirred and mixed until it begins to grow pasty and thick. Next a finely-powdered substance, such as carbonate of lime or other earth, chloride of sodium or potassium, or alumina as a hydrate, like bauxite, may be mixed with the mass to remove or neutralize the excess of free acid. Shortly afterwards the mass is withdrawn from the furnace, and becomes cool, after being roughly broken up.

The soluble matters, comprising sulphates of cobalt, nickel, manganese, and sodium, and a trace of sulphate of iron, are next separated by lixiviation with hot water. To the clear solution enough sulphide of sodium is added to precipitate all the cobalt and nickel with a little manganese, and the precipitated sulphides of cobalt and nickel are separated by filtration, the filtrate being concentrated by boiling to save the Glauber's salt present by crystallization. The liquor afterwards remaining, which contains practically all the manganese, may be evaporated to dryness, and the residue, when ground, is mixed with carbonaceous matter (such as half its weight of wood charcoal). The mixture is heated in a muffle furnace till carbonic oxide ceases to be evolved ; it is then cooled out of contact with air and lixiviated ; the sulphide of manganese thus obtained being converted into oxide by burning in a suitable furnace. The impure solution of sulphide of sodium also obtained can be used for precipitating cobalt and nickel in another operation.

Instead of first separating the cobalt and nickel by precipitation, the liquor may be at once concentrated and the Glauber's salt crystallized, the remaining liquor being afterwards treated as above described. The impure sulphides of cobalt and nickel may be treated with dilute hydrochloric acid to remove traces

of iron and manganese, and be then separated from one another by known means.

[*No Drawings.*]

A.D. 1881, October 18.—No. 4544.

TURPIN, EUGÈNE.—Production of intense heat for melting metals.

Sulphuret of carbon dissolves peroxide of nitrogen or hyponitric anhydride in any proportions. When burning in free air, the mixture gives a brilliant light. In a small lighting apparatus described with reference to a drawing, the mixture is poured into a receiver placed above a curved hair tube, which is immersed in cold water and passes under a steel cupel, wherein the mixture is burnt. For greater safety (the mixture being an explosive) it is preferred that the two liquids (*i.e.* the sulphuret of carbon and peroxide of nitrogen) should be supplied to the burner or fire cup from separate receivers by separate tubes. All carburets of hydrogen and combustible substances in general may be thus burnt with a great increase in lighting power. The burner is fed with a current of cold water. The flame referred to has a temperature which may be estimated at about 3000° Cent. Iron is thereby melted instantly: the mixture of equal quantities of peroxides of nitrogen and sulphuret of carbon is capable of melting its own weight of platinum. Graphite begins to fuse when placed in the flame, which may be applied in all cases requiring a very high temperature.

[*Drawing.*]

A.D. 1881 . . . . . No. 4544*.

Disclaimer and Memorandum of Alteration to the Specification of the preceding invention, filed November 21, A.D. 1882, by E. Turpin.

[*No Drawings.*]

A.D. 1881 . . . . . No. 4544**.

Disclaimer and Memorandum of Alteration to the Specification numbered 4544*, A.D. 1881, filed May 10, A.D. 1884, by the Société Anonyme La Panclastite.

[*No Drawings.*]

A.D. 1881, October 20.—No. 4590.

WIRTH, Frank.—(*A communication from Gesellschaft des Emser Blei-und Silberwerks.*)—"Improvements in chimney flues."

It is stated to have been observed that the quantity of metallic particles or dust deposited in the flues of lead and silver etc. works depends upon the superficial area of the flue walls, increasing and decreasing in the same ratio as the inner surfaces of the flues.

The inner surface of the flues and smoke chambers may be increased by supporting, suspending, or otherwise securing thin plates, woven fabrics, or netting in their interior, parallel to the direction of the draught.

In an arrangement illustrated, thin sheet-iron plates rest on small walls 0·6 metres high built across the flue at intervals to prevent particles already deposited from being carried away by the draught.

[*Drawing.*]

A.D. 1881, October 22.—No. 4626.

APPLEBY, Charles James.—Crushing and treating auriferous and other ores.

Reference is made to the inventor's prior Specification No. 133, A.D. 1880.

Portable apparatus comprises beams or girders of iron plates and angle irons, riveted or bolted together, and having preferably timber piles for a foundation. For two batteries of stamps employed, upon this support (which may have a covering-floor) there are fixed strong vertical frames (of iron plates and angle irons) with struts or stays and crossbeams, to which are bolted preferably wooden guides for the stamp rods. The stamp heads and their boxes are preferably constructed in accordance with the prior invention. Near the upper part of the framework described there are bearings for horizontal revolving shafts with cams or lifters, which actuate discs or lifting-plates fixed by adjustable screws and nuts upon the stamp rods, the latter being preferably cylindrical bars, which can turn round in the guides. On the floor between the two batteries there are arranged a steam engine and boiler (or a water wheel or other driving power may be used) ; and by means of chain wheels or pulleys with endless chains, bands or ropes, shafts (including those previously mentioned), and

coupling clutches, the stamps are actuated as well as the moving mechanism of the buddles subsequently referred to (a like portable framework applying also to the buddles), and cranks may be provided for driving pumps to supply a cistern, whence water flows to the stamp boxes. From the latter the sufficiently pulverized auriferous quartz passes through screens with water into amalgamating-boxes, which may be single, or double and thus constructed. The box is preferably of cast iron, rectangular in plan, and made in one piece, so as to be free from cracks or joints through which mercury might escape, its inside being smooth and preferably enamelled. The box may have a jacket or casing which can be heated by introducing steam, hot air, etc. to facilitate amalgamation. There is a division plate or board, which dips below the surface of the mercury in the box. The crushed ore and water enter the space behind this plate, "descend through the mercury, up which "they rise, part of the gold being detained and amalgamated "with the mercury, and they then pass over" the low front edge of the box and traverse a similar lower box (and additional boxes, if desired). Thence a shoot conducts the crushed matter and water to a portable buddle, being a horizontal pan or vessel of iron plates. A vertical shaft, driven by bevel-wheels from a horizontal shaft, revolves in the centre of each buddle, and carries a horizontal frame provided with adjustable rakes, scrapers, brushes, or cloths, by which the surface of the crushed matter admitted to the centre of the buddle is smoothed. The particles of gold being heavier tend to settle near the centre of the buddle, while the lighter sand fills its outer parts, the escaping water being passed, if needful, through settling-pits to deposit any remaining auriferous quartz. The gold is extracted by known means from the auriferous matter concentrated in the buddle. There may be one buddle (preferably enamelled) for each battery.

[*Drawings.*]

A.D. 1881, October 22.—No. 4635.

LYTE, Farnham Maxwell.—Treating ores, etc.

Reference is made to the inventor's prior Specifications No. 2807, A.D. 1877, and Nos. 1051 and 4932, A.D. 1880.

The different relative volatility of the chlorides of various metals is utilized for separating the more volatile from the less,

in treating ores and metallic compounds or residual products containing silver, lead, or copper, severally or combined, when associated with metals, such as antimony or arsenic, which form more volatile chlorides than the first-mentioned metals.

The pulverized ore, after calcination when desirable, may be mixed with a chloride, preferably salt, and then be treated with fairly dilute sulphuric acid in a vessel (made to withstand the acid and heat) contained in a reverberatory or muffle furnace. The ensuing reaction generates heat, hydrochloric acid is produced, and the antimonious or other volatile chlorides formed begin to pass off. Heat is applied till these more volatile chlorides have escaped, leaving the others for further treatment: the mixture, having been raked about, will have now become dried up.

A like result is obtainable by heating the ore in chambers or cylinders to about 200° or 300° C. in a current of hydrochloric acid gas; or the aqueous acid may be poured over the ore in the furnace. The ore may be sometimes previously agglomerated into masses by means of salt.

Ore, containing very much antimony, may be attacked by hydrochloric acid with heat. The antimony is dissolved, while the lead and silver chlorides are mostly left with the gangue. On cooling the antimonial liquor, the portion of lead and silver chlorides, which dissolved, becomes deposited and may be collected, and if then heated in a furnace, antimonious chloride is driven off provided enough free hydrochloric acid be present. If not, some may be added (or salt and sulphuric acid); or the residue may be drained, dried, made into lumps, and heated in a current of hydrochloric acid gas. Again, a strong solution of ferric or ferrous chloride may be used.

Subsequently the treated ores may be lixiviated with cold water to withdraw soluble salts. From the residue the lead and silver are obtained by brine or by a solution of alkalino-earthy chloride; or the residue may be smelted for the metals present.

The fumes from the furnace treatment described should be passed into a chimney or condenser, from which the chloride of antimony may be collected and metallic antimony extracted. A strong solution of sodium or calcium chloride or of any soluble alkaline or alkalino-earthy chloride may be used for the condensation, and from a resulting clear solution of antimonious chloride the metallic antimony may be reduced by zinc or iron.

Compounds containing copper and nickel, with other metals yielding chlorides volatile at moderate temperatures, may be likewise treated.

[*No Drawings.*]

A.D. 1881, October 26.—No. 4687.

PITT, SYDNEY.—(*A communication from Henry W. Johns.*)—Fire-bricks, etc.

Reference is made to the prior Specification No. 3376, A.D. 1880, which relates to asbestos sheets etc.

Asbestos or other fibrous mineral is to be separated into fibres, preferably as long and fine as practicable. The fibre is then thrown or deposited evenly over the surface of a table or apron to any required thickness, forming a mat or bat, the fibres of which are crossed and interlaced. The whole thickness of the material is made practically in one layer, so that it is not liable to become separated. The bat thus made of pure asbestos fibre is now subjected to a spray or sprinkling of water or glutinous solution, and is afterwards subjected to pressure, so that the interlaced fibres, which are bent about one another, are made to hold together and form a compact solid material.

The fibre may be deposited on a moving table or drum covered with wire netting, against which it is carried and held by means of air currents, there being an exhaust from the under or inside of the table. The moistening, by steam, water, or other liquid, may take place during the deposition of the fibre; so that the mass will become damp throughout. Wires or cords running in various directions may be introduced into the bat as it is formed, to strengthen it. Heavy pressure, between rollers or otherwise, may be applied to the bat, with or without heat: thus it can be made very hard. The material may be moulded to various shapes, and can receive a high polish by the application of heated irons to its surface. When thick, it will form solid blocks for firebrick, fire-walls, etc.

[*No Drawings.*]

A.D. 1881, October 28.—No. 4727.

JENSEN, PETER.—(*A communication from the European Water Gas Company, Limited.*)—(*Provisional protection only.*)—Gas furnaces.

The production of a very high temperature by the aid of

" water gas " is described with reference to the application of the apparatus employed to an open-hearth furnace placed above it. Two systems of regenerators, filled with loose refractory bricks, are used with a common generator ; above which is a hopper for feeding dust or small coal fuel. The high inside pressure requires the apparatus to have a sheet-iron case. Water gas is led through a pipe, properly having a non-conducting cover to maintain the temperature, and, mixed with the air of combustion, enters the furnace through a narrow slit extending its whole width, a very vivid combustion resulting. The products thereof pass through the exit flue and valve into the regenerators, and thence to the boiler and chimney. Steam is decomposed in the heated regenerators into oxygen and hydrogen, and passes into the generator, where it meets a rain of coal dust, with which the oxygen forms carbonic oxide, the hydrogen remaining unchanged. Any little carbonic acid, produced at the high temperature present, is reduced to carbonic oxide as the gases pass through the glowing lump coal in the lower part of the generator, whence they ascend to the furnace of combustion. Two sets of large regenerators are worked together with reversing valves, two and two corresponding valves being combined with a lever so that, when closing one, the other is opened. The valves are formed of refractory material round a strong wrought-iron cross, the lower part of which is conically turned to fit in a ring likewise turned. A small reservoir may regulate the flow of gas to the furnace of combustion.

[*No Drawings.*]

A.D. 1881, November 10.—No. 4925.

JELLYMAN, SAMUEL.—(*Provisional protection only.*)—Raising stamp heads or drop hammers.

An iron or steel band passes over a pulley and is operated upon by a small roller attached to the mainshaft upon which the pulley is hung by side straps connected by two metal straps with a forked lengthening-screw, thus ensuring a direct pull from the main shaft upon the operating-roller. The latter is carried upon an eccentric shaft which is operated on by levers. A catch, to hold up the stamp (or drop hammer), consists of a metal bar suspended at one end and having cut through it an oblong slot. This bar hangs in a slightly inclined plane

horizontally, and through the slot passes the band to which the stamp is attached. Small steel pawls may be fixed in one or both ends of the slot to ensure a firmer grip.

[*No Drawings.*]

A.D. 1881, November 15.—No. 4994.

HADDAN, HERBERT JOHN.—(*A communication from Pierre Py.*)—(*Provisional protection only.*)—Refractory materials.

The waste products or residues of soap factories are first operated on by an hydraulic press, whereby the lye, varying between 15 and 20 p. c. of the products, is extracted and may be used again. Afterwards the products, devoid of all liquid, are moulded and dried, and become hard enough to be used as bricks etc. for building. To make flagstones for paving, cement is mixed with the residues before subjecting them to pressure. The agglomerates obtained by this process, being refractory and waterproof, are advantageously used for constructing furnaces and chimneys.

[*No Drawings.*]

A.D. 1881, November 15.—No. 5010.

HART, BENJAMIN WOOLLEY.—Pneumatic apparatus for separating minerals etc. of different densities.

The inventor's prior Specification No. 1291, A.D. 1879, may be modified by closing the separating box by a cover. At the sides the cover may be formed with openings for the discharge, over the sides of the box, of the lighter portions of the ore etc. treated, there being one or more apertures at the front or small end of the box for the discharge of the heavier portions from the sieve-bed. The air forced through this bed is somewhat confined by the cover, so that its pressure is exerted more advantageously in separating the ore according to specific gravity. The air space below the bed is diminished, either by so constructing the box that there will be only a narrow passage to admit air immediately under the bed and extending from the hopper end to the discharge end of the box, or by placing in the box a wooden or other block with its central portion extending upward into contact with the bed and leaving on either side a space for air beneath the bed. An air channel in the lower surface of the block may convey air directly to the front

of the box. The said cover is supported on the central raised portion of the block, and its thickness or depth is less at the two sides than at the central part, so that two converging channels or troughs, corresponding to the aforesaid air spaces, are formed at the sides of the box for the downward passage of the ore. The lighter grains of ore travel down in these passages till they escape at a higher or lower position, by side openings, according to their size, while the heavier or denser grains pass onward to the discharge opening at the front of the box. The downward movement of the lighter grains a greater or less distance, according to size, obviates the need for auxiliary machinery, such as sizing-machinery, when the grains differ in size as well as in specific gravity. The under surface of the cover is formed with a set of cells or compartments, closed towards the centre of the cover, but open at their outer sides for the discharge of the lighter grains over the sides of the box. These cells, which diminish in width from the rear to the front of the machine, communicate with each other and preferably have an inclined upper surface, or the latter may be parallel to the under surface. Thus provision is made for arresting or retarding the downward flow of the lighter grains, so that they will more readily escape by the side openings. Small plates or stops form divisions in the openings between the sides of the box and the sides of the cover, to further check the said downward flow. Between the lower edge of each stop and the bed there is a space for the continuous downward flow of the heavier particles. The air may be sometimes passed from the air chest to the bed through a perforated plate to equalize its distribution. A Root's blower is preferred for compressing the air, as it produces intermittent currents. An inclined discharge spout at the front of the box may have a valve, so that the discharge may be varied or stopped.

[*Drawings.*]

A.D. 1881, November 17.—No 5047.

WILSON, Alfred.—Gas furnaces.

Metallurgical heating and melting furnaces may be constructed in the following manner to be heated by gas, the details being arranged to fit the furnace to its particular purpose

notably as regards the size and shape of the chamber or hearth in which the gas mixed with air is burnt. In the case of a smiths' hearth, gas from a generator is conducted preferably to the summit of the hearth or chamber and enters it at its rear end. An air-supply pipe, terminating in a cone or other regulating valve, opens in the gas-supply channel, so that air mixes with the gas, the quantity of which is also controlled by a throttle or other valve. The stalk of the cone valve may project through the top of the air pipe or case, and be jointed to a lever provided with a connecting rod, which terminates in a screw, whereon the screwed boss of a hand wheel rotates to regulate the valve. Thus air from a fan or other blower is delivered under pressure in the middle of the current of combustible gas, and the mixture when ignited forms a large blowpipe flame, by which the hearth and its contents are heated. The upper part of the hearth may be contracted to ensure the effectual mixing of the gas and air. The products of combustion leave the hearth preferably by side openings and traverse a flue, through which the pipes conveying either the gas or air, or both, pass; the latter being thus heated by the waste heat, an increased heating effect is obtained; or the air and gas may be otherwise heated. Branch pipes from gas and air mains, laid at the back and preferably below the ground level, may conduct gas and air to the hearths of a row of furnaces.

[*Drawing.*]

A.D. 1881, November 25.—No. 5155.

COBLEY, Thomas Henry.—Refractory materials.

The manufacture is described of mineral white substances for various purposes, including for mixing with fireclay, asbestos, or other refractory material for making fireproof goods. Hydrate of lime, freed from grit by levigation, may be continuously added to a solution of sulphate of magnesia (native sulphate or kieserite, for economy) under agitation or stirring until precipitation ceases. After settling a paste is left on running off the liquid, or while a precipitate is forming the mixture may be passed through a filter press and the white precipitate be obtained in cakes. The white thus prepared is a mixture of precipitated sulphate of lime and hydrate of magnesia. For

certain purposes, warm saturated solutions of sulphate of magnesia and chloride of calcium may be mixed and a precipitate of flaky sulphate of lime be obtained. To the residual chloride of magnesium liquor there may be added hydrate or carbonate of lime to obtain a precipitate, which may be mixed with alumina. Some chloride of aluminium may be added to the chloride of magnesium liquor.

[*No Drawings.*]

A.D. 1881, November 29.—No. 5209.

HOPKINS, Alfred Nind.—Coating metals.

A method of coating tin plate or other sheets of metal or articles made from them, with varnishes, lacquers, japans or similar coating-materials either alone or mixed with colours or stains.

The coating is applied with a roller, preferably made with a wooden or iron core, covered with a yielding material such as vulcanized india-rubber or leather. When the roller is quite smooth, or when the coating-material is mixed with much varnish, or is otherwise made of a light consistency, the coated article has a smooth appearance; when the coating-material has a greater consistency, the coated surface has a grained appearance, the distinctness of the graining depending on the consistency of the coating material and the roughness of the roller.

When hand rollers are used, the material is taken from a plate stone or other flat surface on to the surface of the roller, which is then passed, backwards and forwards over the surface to be coated, pressure being used.

A convenient form of machine for coating plates has three rollers, the pressure of which can be regulated by screws. The coating material is supplied to the top roller by a hopper, and to the bottom roller by a bath, the middle roller being supplied from the upper and lower ones. The plates are passed backwards and forwards between the rollers, first between the bottom and middle, then between the middle and top ones.

The coated articles are stoved in the usual way, preferably at a high temperature.

[*Drawing.*]

A.D. 1881, November 30.—No. 5246.

GLASER, Friedrich Carl.—(*A communication from Franz Büttgenbach.*)—Separating ores, minerals, etc.

This is effected by the aid of their different degrees of hardness or cohesion. The mixed material is thrown against a hard surface with such centrifugal force that the more friable particles are broken up, while the harder are left intact ; after which separation is effected by screening. The material for treatment, all particles of which should be as nearly as possible of uniform size, is introduced into the top of a centrifugal machine, preferably constructed with several stages one above another, so that the material in descending is repeatedly thrown against the walls. From the bottom it passes into a drum, having screening surfaces of different degrees of fineness. The first compartments will deliver the disintegrated material in an almost pure state, while the residuum from the last compartment can be further sorted. Some sorted portions may be separately treated again. The admission of a water jet into the centrifugal machine or a spray playing over the drum is advantageous, or the process may be carried out with dry materials. The machine should not smash or grind the material ; its speed must be adjusted to the size and character of the material and also of the machine. A cylinder, about 900 millimetres high and 1100 across internally, may contain three removable chilled cast-iron rings, constructed in separate toothed segments and arranged at different heights. A central vertical rotating axis carries three horizontal discs with radial ribs. The material, introduced through a hopper at the top, falls on to the upper disc near its centre, is thrown against the rings, and is directed by a conical shoot towards the second disc, this operation being repeated twice before the particles escape through a shoot to a screening drum. If a mixture of pyrites and blende be introduced and subjected to a speed of 400 revolutions a minute, the pyrites will issue almost intact, while the blende will be broken ; so that the two can be separated by screening. Two revolving drums, having an inclination of 6 in 100, making some 8 or 9 revolutions for every 100 of the crushing-machine, and with meshes varying from 1 to 8 millimetres, may be employed in succession.

[*Drawing.*]

A.D. 1881, December 1.—No. 5257.

PITT, SYDNEY.—(*A communication from Henri Harmet.*)—Furnace for purifying metals.

The metal and reagents are charged into the top of a vertical receiver at the lower part of which fusion takes place, and the melted mixture passes along the inclined sole of an adjoining combustion and purifying chamber, constant change of the surfaces in contact resulting. Thence a fixed or movable crucible receives all the liquid matters, and the metal collects at ts bottom after having gradually traversed the upper layer of purifying-slag. The crucible, which has upper and lower outlets respectively for the slag and metal, is shown in a drawing as placed centrally under the combustion and purifying chamber, at one end of which are inlets for combustible gases or volatilized oils and an air blast to form a burner, a jet being directed upon the lower part of the receiver at the other end. The said chamber also has an entrance for blast for heating the crucible. A jet of air under low pressure may be thrown into the crucible to agitate the contents and hasten the reaction. Contact with solid fuel is avoided. The invention applies especially in making cast steel.

[*Drawings.*]

A.D. 1881, December 2.—No. 5271.

CLAUDET, FREDERIC.—Purifying precipitated copper.

The copper, as usually precipitated from cupreous solutions by means of iron, is contaminated by arsenical compounds, which deteriorate the quality of the copper obtained by smelting the precipitate. To remove the said compounds previously to the smelting, so that ingot or cake copper may be obtained free from arsenic, the inventor treats the precipitate, while wet or when partly or completely dried, with a cold or heated solution of caustic or carbonated alkali (soda or potash or both). Thus the said compounds are converted into soluble arsenical salts of the alkali, which are removed from the precipitate by the alkaline solution and by washing with hot or cold water. Sometimes it is preferred to moisten the precipitate with a strong alkaline solution, and, after drying the mass, to heat it in a muffle or other furnace, the said arsenical salts being

removed by subsequent lixiviation with preferably heated water.

[*No Drawings.*]

A.D. 1881, December 6.—No. 5328.

PITT, SYDNEY.—(*A communication from Fred Brotherhood.*) —Quartz crushers.

Machinery for pounding and cleaning rice is described, and is partly applicable to quartz crushers etc.

Gripping-rolls or revolving nippers are employed with mechanism for adjusting them and controlling their action upon the lifter of a pounding pestle (or of a hammer, stamp, etc.). Symmetrical or truly-cylindrical gripping-rolls are preferred, one being a positively-driven roll and the other an idle roll. The former roll is fastened on a driving-shaft, which carries a pair of cams on opposite sides of this roll. A vibrating bifurcated frame is pivoted on a supporting-frame so that it may rock vertically, and it carries rollers to bear upon the peripheries of the said cams. This rocking frame has a cross-bar with an opening for a sleeve, which, by the aid of a hand-wheel and screw surfaces, and subject to the regulating action of opposing springs of different strengths, can be moved endwise along a rod constituting the shank or controlling arm of a yoke. This movement, by rocking the frame, causes the rollers to move toward or away from the cams ; and thus they can be held to the cams with a suitable yielding pressure. The yoke has forks, pivoted with an eccentric rocking frame, which has a heavy roller or weight constantly tending to rock the eccentric frame downwards or away from the driven roll. This frame also has eccentrics or rollers supported in bearings or boxes in the supporting-frame The idle roll is fastened upon a shaft, which is mounted eccentrically and so as to turn loosely in the said eccentrics. Thus, when the projecting parts of the cams on the driving-shaft act on the rollers of the first-mentioned rocking frame, a movement is transmitted to the idle roll : and the two rolls will firmly, though yieldingly, press on the opposite sides of the lifter, which is raised ; and then it drops, when released from the rolls by the recesses in the cams allowing the idle roll to swing away from the lifter. The latter is made tapering, a tight grip of the rolls being secured in starting and the risk of slip then taking place being avoided. A spring, in connection with the lifter

and pestle rod, assists in the proper action of the rolls on the lifter in starting; and lessens the risk of breakage if the rolls, owing to overspeeding, catch the lifter as it descends. Arrangements are described for arresting the movement of the lifter and pestle, one pestle of a series being stopped without the rest. The invention further relates to the mortar in which the rice is treated.

[*Drawings.*]

A.D. 1881, December 7.—No. 5359.

RICHARDSON, FREDERICK.—Process of uniting metal with india-rubber.

The metal is prepared by cleaning it in a bath of diluted sulphuric acid, washing it in water, and allowing it to dry; then covering it with rubber cement, allowing the coating to dry, and applying another coating of cement if desired. A thin sheet of soft rubber is then pressed on to the metal by a heated roller or plate, and the india-rubber cemented to this, and afterwards vulcanized if desired. The sheet of soft rubber may be omitted without departing from the invention.

[*Drawings.*]

A.D. 1881, December 8.—No. 5366.

GALBRAITH, WILLIAM.—Extraction of nickel.

Ores or combinations, containing iron, lime, magnesia, silica, and like substances, besides nickel, and "matte," "speiss," or other intermediate products from the smelting or roasting of nickel ores, may be treated. The ore or combination is first ground, if needful, and dissolved in (preferably hydrochloric) acid; the solution is diluted with water and run into, say, a wooden tank; and sufficient lime, chalk, or other alkaline substance is added to neutralize the free acid. Afterwards the solution is heated by steam or otherwise, and a combination of sulphur and calcium, such as the sulphide or hyposulphite of calcium either prepared or as waste or bye-products from other processes, like tank waste or yellow liquor from alkali works, or lime waste from gas works, is added in sufficient quantity to precipitate all the nickel, iron, alumina, and the like. When the precipitate has settled, the clear liquor above may be removed by a tap or siphon, after which water and hydrochloric

acid are added in such mutual proportions that the sulphide of iron and other impurities will be dissolved and may be run off as waste, while the sulphide of nickel is left, to which more water or water and acid should be added, if needful, until it is pure. The washing might be effected by filtration in a tank with a false bottom, perforated or otherwise arranged to separate the liquid from the precipitate.

The process described is preferable to adding the hydrochloric acid to the precipitated sulphides before separating the liquor therefrom. Where oxide of iron, alumina, and like impurities can be first precipitated by lime, carbonate of lime, or other alkaline substance, this may be done and the nickel be afterwards precipitated from the filtrate from these impurities as described.

In treating speiss or other nickel compound containing arsenic, " a large excess of the said sulphide of calcium is used " when precipitating the sulphides of nickel, iron, and the like, " in which sulphur of arsenic is soluble."

[*No Drawings.*]

A.D. 1881, December 9.—No. 5389.

DICK, George Alexander.—Alloys.

Reference is made to the prior Specifications Nos. 2306 and 5313, A.D. 1880.

To deoxidize the oxide generally present in copper and in any usual alloys of copper with tin or zinc (spelter), and to produce superior alloys, the inventor introduces, into the copper or alloy, iron in the form of phosphuret of iron, or in that of iron combined with phosphurets of other metals so as, on melting together, to produce phosphuret of iron or its equivalent. Improved alloys of copper may be likewise formed in such manner that part or all of the phosphorus remains in the alloy ; and to these latter alloys lead may be added.

The inventor uses phosphuret of iron, or iron combined with phosphuret of copper or of tin or phosphurets of those metals or one of them combined with zinc. Thus, 1 part of iron may be melted with from 1 to 2 parts by weight of phosphuret of copper or of tin, and the copper or tin will remain present with the phosphuret of iron formed. Or refuse of galvanizing works, consisting mainly of zinc with from 3 to 5 p. c. of iron,

may be melted with phosphuret of copper, tin, or iron, and the ingots produced therefrom are added to the melted copper or remainder of the copper, if any, required for forming the improved brass. The copper, tin, or zinc present with the phosphuret of iron can be allowed for in producing the improved alloys. Phosphuret of iron melts at a comparatively low heat and is readily taken up by the copper or alloy. The oxygen of the above-mentioned oxide is taken up in the melting process by the phosphorus of the phosphuret of iron and forms a slag to be skimmed off, while the iron alloys with the copper and other metals present. The amount of phosphuret of iron added should produce an alloy containing from about 0·1 up to 10 p. c. of iron, and the quantity of oxide present regulates the amount of phosphorus required for deoxidation, the proportions of iron and phosphorus in the phosphuret being varied according to circumstances. When alloys containing phosphorus are desired, the phosphuret of iron employed must contain more phosphorus than is required for deoxidation. The phosphorus in these alloys renders them more fluid when melted. In the case of brass, the phosphuret of iron may be first melted (either pure or produced as above described) and the spelter or rest of spelter gradually added; and the ingots produced therefrom are added to the melted copper in the usual proportions. From 2 to 10 p. c. of lead may be added to the gun metal or brass contained in the said improved alloys when intended for bearings, allowance, however, being made for any lead already present, as frequently in gun metal.

The use of phosphorus in other ways is not claimed.

[*No Drawings.*]

A.D. 1881, December 10.—No. 5416.

LYTE, FARNHAM MAXWELL.—(*Provisional protection only.*)—Treating the gases of furnaces, calcining-kilns, etc.

Reference is made to the prior Specifications No. 633, A.D. 1877, (which involves the formation of zinc oxide), and No. 3443, A.D. 1881.

As an improvement on the secondly-mentioned prior Specification, the present inventor absorbs the sulphurous acid in the gases by means of hydrate of zinc or one of the hydrates of iron. The corresponding oxides may be

placed in trays or on hurdles or perforated shelves within the flues of the furnaces etc., or in chambers connected with the flues ; or may be mixed with water to form a cream and beaten up or sprayed into the atmosphere of the flue, or run in fine streams so as to effect their intimate contact with the passing gases, which may be cooled to about 212° F. by spraying water into them. Thus sulphites are produced, and, in the case of the higher oxides of iron, some of the sulphites become converted into sulphate of ferrous oxide. The salts of the sulphur acids thus formed may be collected, and on being raised to, say, a low red heat, sulphurous acid is again disengaged and may be collected for use. Intermixture of pounded charcoal or other reducing agent with the sulphites promotes the said disengagement. In lieu of the said hydrates, the carbonates may be used, or other metallic hydrates or carbonates, as of calcium, copper, or nickel, might be employed.

[*No Drawings.*]

A.D. 1881, December 21.—No. 5589.

LAKE, Henry Harris.—(*A communication from Claude Theodore James Vautin.*)—Refining impure copper.

The impurities may be removed by (1) oxidizing or (2) chloridizing them.

(1) As an improved oxidizing process, a current of oxygen alone or with other gases (preferably as air) may be forced through the whole mass of molten copper, so as to oxidize at once all or nearly all the impurities, which rise to the surface and are skimmed off. Again, oxygen-producing solids may be thoroughly mixed with the melted metal. Metallic oxides, which yield oxygen under heat, may be used in admixture with a flux or reagent : thus, one part of binoxide of manganese, oxide of copper (copper scale), or sesquioxide of iron (hæmatite iron ore) may be mixed with 2 or 3 parts of slaked lime or soda ash, the materials being ground. The mixture employed is thrown on the surface of, and thoroughly rabbled into or mixed with, the melted copper, and then the heat should be raised to render the slag as fluid as possible for its careful removal. The operations of poling and casting are conducted as usual. In refining by oxidation, the copper is preferably

treated with from 2 to 3 p. c. of its weight of the mixture of oxide of copper and slaked lime.

(2) A current of chlorine or hydrochloric acid gas may be forced through or into intimate contact with every particle of the melted copper, especially when containing bismuth, to remove the impurities in the form of volatilized chlorides ; a crucible, Bessemer converter, or other vessel may be used. Again, a chlorine-producing composition, consisting of a chloride and its reagent, may be gradually and thoroughly mixed with the melted copper (after the slag has been skimmed off) to likewise expel the impurities. During this operation the damper should be closed to check waste of chlorine by the draught. In refining by chloridization, the copper is preferably treated with a mixture of 1 part of common salt and from 3 to 3½ of slaked lime.

[*No Drawings.*]

A.D. 1881, December 30.—No. 5731.

CASSON, RICHARD SMITH.—Furnaces and furnace doors.

Reference is made to the prior Specification No. 243, A.D. 1876, which relates to heating reverberatory furnaces.

A gas generator chamber has an inwardly-inclined front with grate bars at the base. Between these bars air for combustion enters from a closed chamber to which a regulated quantity of blast is supplied by a fan, but with some fuels the air may pass directly to the bars. A large hopper or feed chamber is so placed that the fuel will fall on said incline and gradually sink down to the furnace bottom. The hopper has double valves for admitting regulated quantities of fuel without much air ; the neck of the hopper being so inclined as to automatically feed without manual labour. Opposite the inclined front are a set of metal or refractory air-heating pipes or channels, around which the gases circulate, a perforated protecting fire-brick wall being built in front of these pipes, which are supplied with air or blast under pressure through boxes or channels at the bottom of the generator. The heated blast passed from the pipes through channels preferably along the sides of the gas flue to the fire-bridge ; where, passing through compressed openings preferably upon both sides of the stream of gases from the producer, it burns the gaseous fuel.

Sand or the like, placed above the firebridge and hot air channel, keeps in the heat. An outer wall or casing or an iron tank is provided to prevent the intimate contact of moisture with the producer, and similarly as to the hot air channels. In small furnaces the blast may be carried under neck and bottom or sides to heat it. The usual cast-iron doors of reverberatory or puddling-furnaces withstand with difficulty the great heat of combustion thus produced. Puddling-furnaces may have reversible doors with a rabbling-hole at the top, not exposed to the direct furnace heat when the door is closed. When the lower hole is injured, the door is reversed and the other hole used. In reverberatory furnaces the flanges of the door upon which the brickwork rests are rapidly injured : but by casting the door with flanges on both sides, when one side is worn, the bricks can be removed and, by reversing and lining the other side, a double life be got out of the door without much increase in the weight of metal used. Or the doors may be made reversible as for puddling-furnaces.

[*Drawing.*]

1882.

A.D. 1882, January 2.—No. 10.

BREWER, Edward Griffith. — (*A communication from Thomas Martin.*)—Tuyères.

To push away obstructions from the nose of the tuyère or its air passages in blast furnaces, especially in treating copper ores and pyrites in furnaces where the air is passed through the molten metal, a rod or poker is provided for each air passage

and is long enough to pass quite through it. These rods are "preferably attached to one common head working in an iron "case, such head having a rod like a piston rod attached to its "other side which passes through a stuffing box to prevent the "escape of the air blast. This rod may be worked" by connecting it by other rods to a lever carried by a standard. The lever should receive a rapid to-and-fro motion once, or more often if needful.

[*Drawing.*]

A.D. 1882, January 11.—No. 142.

WOODS, George and WOODS, Edwin.—(*Provisional protection only.*)—Finishing galvanized or metal-coated iron or steel wire.

The wire is passed, after leaving the coating bath, and when hot, into contact with asbestos or other silicious material to polish it and remove superfluous metal. The asbestos pads are secured in holders, alternately above and below the passing wire, and any required pressure on the pads is obtained by screws. The pads may be made in halves, or parts, and the wire passed through one or more of them.

[*No Drawings.*]

A.D. 1882, January 14.—No. 204.

VAUGHAN, George Edward.—(*A communication from Fritz Lürmann.*)—Distillation, sublimation, &c.

To effect continuous working and to avoid the interruptions of ordinary discharging and recharging, zinc ores (to obtain zinc) and various other materials may be treated in distilling chambers, which are charged mechanically. The materials are gradually moved forward, warmed, distilled or sublimated in these chambers through the charging apparatus, after which all the products enter a discharging chamber. The volatile products pass from the latter by pipes through the top of the vaulting or through the sides of this chamber into ordinary apparatus for cooling, purifying, &c. To remove the solid products without interrupting the distilling operation, the said pipes are closed so as to produce some pressure of gas in the apparatus : thereupon airtight-closed

doors may be opened one after the other and the solid products may be removed without air entering.

The distilling chambers may be arranged independently or together at discretion; they may be on one or more levels. Their cross section may increase from the charging to the discharging side as by a divergence of the side walls, depression of the floor, or incline of the vault. They can be constructed of one or several parts. Products of combustion or other heating medium may circulate in flues around them and work upon the materials for treatment. The separating walls of the chambers and parts around them must be as thin as possible to check loss of heat, ordinary or special bricks being used in different arrangements.

The form and size of the charging-apparatus must conform to those of the distilling chambers. A circular or oblong piston may work in a cylinder, which projects at one end into the chamber and is secured thereto. On the backward movement of the piston, the materials fall through a charging funnel [and are forced ?] into the chamber by its forward movement, a hand-wheel or pulley in connection with mechanism communicating a to-and-fro movement to the piston. A movable apparatus, running on rails in front of a set of chambers placed side by side, may be used for charging each in turn. The charging apparatus may serve as discharging apparatus, the materials already treated being pressed out and those to be treated pressed in.

The invention is further described with reference to the use of such chambers as gas-expelling chambers or generators, and in this connection the prior Specification No. 4252, A.D. 1877, is referred to, the present invention including the production of coke &c.

[*Drawings.*]

A.D. 1882, January 14.—No. 205.

MEWBURN, John Clayton.—(*A communication from Josias Tayler.*) — (*Provisional protection only.*) — Reducing rock, ores, &c.

Between the parallel side plates of an iron frame, two cast-iron or other jaws are suspended on rods, which rest in bearings so placed in the frame as to give the desired opening between the

jaws to receive the rock for treatment. The bearings may be in a line parallel to the base of the frame; or one jaw may be lengthened above and its bearing may be arranged higher up than the other, the similarity of the lower portion of the two jaws being retained. A rod, which passes through a hole in the lower portion of each jaw, projects through side slots in the frame. These rods are tied at the ends by a link, arranged to play backwards and forwards on the outside of the frame, and held in place by collars at the ends of the rods. The link is provided with a boxing and a wedge-shaped key, which is moved up and down and kept in position by screws to adjust the proximity of the lower ends of the jaws. One or both jaws have face plates with lateral serrations or corrugations on the upper part to better hold the rock in position as the jaws move. Curved projections so run across the lower part of the faces, with or without corresponding hollows, that when the jaws are in perpendicular position the projections on the two jaws will be opposite to each other so as to come as nearly in contact as the link will permit. The inner surface of the frame is cut away opposite to the opening between the jaws for a renewable cast-iron or other slide of such thickness as to bring its surface in close proximity to the edge of the jaws. The face plates, which may be in two separately removable pieces, are secured by bolts passing through the jaws, their heads being embedded in flanged grooves in the face plates and made permanent by filling in with Babbitt metal or other substance. To prevent the strain on the bolts by the peculiar action of the jaws, the face plates have a flange on the back to fit into a groove extending laterally across the jaw. To operate the jaws, a crank shaft has bearings in the frame and is provided with balance wheel and pulley, the crank being in the centre between the sides of the frame and being connected with the jaws by a pitman, one end of which is secured by a clamp around the crank, and the other in a recess in the jaw behind and around the hole for the rod and connected to the jaw by passing the rod through this hole and through a corresponding hole or clamp in the end of the pitman. The jaws are oscillated to and fro with a crushing grinding motion, the rock placed between them being first crushed and then ground into a granulated or pulverized mass according to the adjustment of the bottom of the jaw.

The method of securing a proper configuration is described at length.

[*No Drawings.*]

A.D. 1882, January 19.—No. 275.

GOWANS, Louis Ferguson.—Amalgamating and extracting gold and silver from their ores.

Auriferous sand, pulverized quartz, or other ore is admitted with water into a hopper at the upper end of a revolving vertical hollow shaft, preferably driven by bevelled wheels from a horizontal shaft, and supported preferably at its upper end by a collar, which revolves on a fixed support or bearing, steel or other washers being interposed if required. To the lower end of the revolving hollow shaft is fixed a preferably cast-iron block, having at its upper part a vertical central opening which communicates below with, preferably four, outwardly descending curved outlets for the sand and water to pass into a circular horizontal preferably wrought-iron pan or dish, supported on a frame or foundation immediately beneath the hollow shaft. A collar at the upper part of the said block carries a horizontal, preferably cast-iron grinding plate or muller, which is made in four or more separate removable segments, bolted or keyed together. To the bottom of each segment is fixed a flat copper plate, the lower surface of which is amalgamated with mercury and adjusted to revolve at, say, 1½ inch from the bottom of the pan, wherein a quantity of mercury is placed. A circular, vertical, or slightly inclined flange is preferably formed on the outer diameter of the segments, concentric with but of less diameter than the edge of the pan, so that an annular space intervenes. By the pressure of the water the sand is pressed absolutely through the mercury in the pan and upon the copper plates, so that no particle of gold can escape amalgamation if the ore be crushed fine enough. The lower surface of the plates has curved inclined grooves in continuation of the said outlets, whereby the distribution and amalgamation of the metal is better effected. The sand, deprived of gold, passes from under the muller and is carried with the water over the edge of the pan, which has a plugged opening for withdrawing the mercury or amalgam.

Ores, having a coating over the gold or silver of mundic or

like substance without affinity for mercury, are amalgamated in a dry state, and to the mercury employed there is added about $\frac{1}{4500}$ of a composition produced by gradually adding 17 per cent. of metallic sodium to mercury heated to about 300° Fahr. The sodium frees the particles of metal from their coating and ensures thorough amalgamation. In this case the hopper may be immediately above the revolving hollow block to which the muller is attached, the ore being made to pass under the amalgamated copper plates by the revolution of the latter, and being forced down if needful by revolving blades or screws.

The bottom of the muller may have straight or curved ribs, projections, or depressions to promote contact of the ore with the mercury. The pan may be sometimes surrounded by a steam or hot-water casing or jacket to heat the mercury.

[*Drawings.*]

A.D. 1882, January 24.—No. 368.

CARR, William John.—(*A communication from Phocion Négris and Eugène Rizo.*)—(*Provisional protection only.*)—Purification of lead.

Steam is injected into the bath of lead coming from the reducing furnace as soon as the cake of scoria has been removed, as also the matte and speiss if any. As long as the lead is red hot it is rapidly purified, the clearing off of the dirt being also easily effected as long as there is copper to be oxidized, the oxides running into lumps or clots removable by a rake. As the copper is eliminated, the oxides become greenish (instead of black) and form over the bath an oily layer not easily removable. Organic matter, such as rack or stable dung which yields alkaline ashes, is now added to gather together the oily layer, while the steam stirs up the mass ; or caustic soda, quicklime, or an equivalent may be used. The steam, which produces an agitation like that of a piece of green wood in the ordinary process, should be introduced as low as possible and by several openings at the ends of a kind of goose's foot of iron, to better agitate the whole mass and effect entire contact with the air, which is the principal oxidizing agent. The lead can afterwards be desilverized at once.

[*No Drawings.*]

A.D. 1882, January 27.—No. 410.

CHAPMAN, Gavin.—(*Provisional protection only.*)—Separating oil or tar from blast-furnace gases.

The gases are passed through a vessel or chamber containing perforated diaphragms, discs, or screens, which are kept wetted with water and are placed across the vessel so that the gases must pass through the perforations. Metal is preferably employed so that the cooling actions may be rapid.

Again, circular perforated discs may be fixed on a longitudinal shaft, which rotates so that all parts of the discs become wetted; the lower part of the vessel containing water, whilst the gases pass along the upper part through the perforations. Or the diaphragms may be arranged to dip vertically into and rise out of the water; or they may be stationary and the water may be continually distributed over their upper ends. Also currents of cold water may be passed through pipes or passages in the vessel to afford much cooling power.

[*No Drawings.*]

A.D. 1882, January 27.—No. 426.

COLLIER, Stephen, junior.—(*Provisional protection only.*)—Calcining limestone and roasting ores.

Lime-burning is described. The kiln employed, at some distance from the top, is completely arched over the entire area with special firebricks, each containing a perforation, say, two inches across for the passage of air and piping. Over this arch and separated from the lower one by a layer of fireclay or sand, another arch of ordinary firebrick will be built and the top levelled with firebrick. The two-inch holes pass through from bottom to top. This is the floor of the kiln; and in its centre will be a hole, say, 15 inches across and, say, 4 other holes 12 inches across. These are the drawholes. Firebars beneath will prevent fuel and stone from falling through. A chamber beneath the arch may have a side door (to be closed during burning) for wheeling out the lime. Suspended beneath the arch, there are annular rings of gas piping connected with a supply pipe. To the rings are connected vertical pipes, which are inserted in the small holes in the arch. These will convey the gas or oil igniting agent. The jets of flame will quickly fire the coal, which is distributed over the floor of the kiln and

intermixed with the limestone. A strong draught is indispensable ; it will carry the flames up amongst the fuel and stone, disengage the carbonic acid gas in the stone, turn it into carbonic oxide, an inflammable gas, and these gases from fuel and stone, fed by the oxygen of the strong current of air, quickly develop a strong fire. The stones are heated slowly : a small flame is first used, and afterwards the gas is turned full on, while the draught aperture is gradually enlarged. The fire may be regulated, if too strong in one part, by there lowering the gas and inserting stoppers in the air holes ; and *vice versâ* if the fire gets weak. A steam jet is used under the arch, and then "the quantity of coal required is much less when the " stones are moistened." The kiln is covered over ; an iron floor above it serves for drying bricks ; and above this is a roof with a stack to assist draught and carry away waste products : or a small fan will create sufficient draught for rapid combustion. Every charge is a separate calcining operation, which is under complete control, less coal than usual being wanted.

[*No Drawings.*]

A.D. 1882, January 27.—No. 427.

JENSEN, PETER.—(*A communication from Wilhelm Wilmsmann.*)—Furnaces.

To effect complete combustion in furnaces for reheating, smelting, &c., a hanging bridge or arch is " arranged over the " grate at or near the back end of same so as to compel the " gases from the raw coals thrown on the top of the fire to pass " under the said bridge and the firing or stoking should be so " that the fuel is heaped up towards the back of the grate so " high that the gases there pass through it." Just behind this bridge are air flues, which supply heated air from the sides of the furnace, so that as the gases emerge from under the bridge their combustion is completed. The said bridge may be hollow for the passage of air (or water), and may thus act as a hot-air supply flue, while overheating is checked. To prevent the smoke &c. from striking out " into the stoke hole when the fire " door is opened, lateral flues are provided by which the smoke " and gases can pass off to the side near the front or door end " and emerge into the fuel close to and below the hanging " bridge."

[*Drawing.*]

A.D. 1882, January 30.—No. 456.

SHILL, RICHARD EDMUND.—Crushing, grinding, and pulverizing ores &c.

The ore is fed into the machine by an endless screw conveyer, actuated direct from the main driving-shaft without the aid of gearing, and is then operated on by a plain or serrated metal or other roller or rollers, each mounted on one end of a lever, the reverse end of which is acted on with a regulated force by a spring. The reaction of the spring tends to force the periphery of the roller against the interior of a revolving disc and thereby to greatly increase its crushing or pulverizing power. The levers work through bosses cast on the main revolving disc as they are acted on by the pressure of the ore and by the reaction of the springs. The machine need not have so great a speed as when the pulverizing power of the rollers depends on centrifugal force alone. The main revolving disc is driven by a pulley on the main shaft; and a second disc is driven independently to cause a differential motion of or between the discs, either in opposite directions or in the same direction, or with the second disc stationary. Within the second disc or drum, the rollers work, and the two discs form together the chamber in which the ore is treated. Owing to the differential motion of the discs, the ore is kept in continual motion and thrown to all parts of the rollers' path to be acted on in all parts of their course. One of the discs also has apertures for the escape of the pulverized ore. The two discs are adjusted with their faces as far apart as required to form a measure of the fineness to which the ore is reduced by a screw working in the outer end of the main shaft, which acts on a cottar or plate working in a slot in the shaft, the cottar pushing forward a loose collar which works against a fixed collar on the sleeve of the main revolving disc: thus the required resistance is given and the fineness of reduction of the ore is controlled. Again, the cottar may be arranged with nut and screw end, or a pair of check nuts on the outside of the shaft may be used. On withdrawing the cottar, the loose collar can be slid back on the shaft, when the machine becomes disconnected, and the internal parts can be renewed. The faces of the discs will remain true owing to the manner in which they revolve. The screw conveyer can be readily withdrawn by unbolting a plate at the end of the

machine. Various materials may be operated on ; and sometimes, a stream of water being passed through the machine, fluid or semi-fluid substances may be produced by it.

[*Drawing.*]

A.D. 1882, February 6.—No. 570.

JACKSON, William Sychar Reed.—Purifying gases and condensing fumes or vapours.

To separate particles of metallic or other substances or compounds, especially of lead and zinc, from furnace gases or fumes, the gases are passed under a level or slightly inclined shelf, with or without grooves, corrugations, or the like, and so placed with its lower surface in contact with water or other liquor that the gases pass in thin films between the liquor and the shelf. The friction between the particles in the fume and the wet shelf, and the constant washing of the shelf by the liquid, cause the separation of the particles. If insoluble, they subside ; or the muddy liquor may be constantly replaced by fresh liquor and withdrawn into a settling pit.

A wooden tank, about 8 feet square and 3½ deep, may have a horizontal wooden shelf about 2½ feet from the top of the tank. According to the description and drawing, partitions are placed equidistant from opposite sides of the tank and reach from its top to the sides of the shelf. The portions of the tank between its sides and the said partitions are covered to form airtight compartments ; and one compartment contains the inlet for the gases and a supply pipe for the liquid, while the other contains the outlet for the gases and a swivel overflow pipe, by which the height of the liquid may be adjusted and the contents withdrawn. It is preferred to draw the furnace gases under the shelf by an exhausting machine. The gases, before entering the condensing apparatus, need not be cooled below 350° Fahr., a moderate heat being desirable, as the formation and condensation of steam aid the separation of the metallic particles. A lining of iron plates should protect the compartment which receives the gases.

[*Drawing.*]

A.D. 1882, February 7.—No. 580.

MORGAN - BROWN, William. — (*A communication from Alexander C. Felton.*)—Furnaces.

In the fire-chamber of a smelting or other reverberatory furnace, the side walls may incline inwards and upwards from the edges of the fuel-supporting grating towards the middle of the furnace, to reduce the pressure of the fuel against these walls and prevent adhesion of clinker thereto. Also there may be upwardly extending gratings at the sides (or upwardly extended side gratings) and side dampers, which may be operated simultaneously by a combination of rods and levers to control the draught of air through these gratings: sometimes the dampers are dispensed with. The bearing bar of the furnace grate may have two ribs, each to support the ends of adjoining sections of grate bars, and notches to ensure the proper spacing of the bars which have notches to engage the notched ribs. The side bars of the furnace grating may be bevelled at their ends for ready removal from their supports. The bars of the upright gratings may be tapered from end to end in their thickness measured parallel with the walls of the furnace, to afford a variable amount of space for the passage of air between them. A series of bars may be connected together to form a continuous grating and be strung or mounted at one end upon a rod pivoted and supported on a bearing bar, there being a removable support for the other end of the bars, whereby the entire grating may be permitted to turn on the pivoted rod to remove the fuel from the furnace. There may be a perforated refractory lining above the upright gratings with a continuous air passage behind the gratings and lining. The invention also includes the main bearing bar of a grate provided with notched wings and a series of grate bars with perforated lugs and rods passed therethrough, one rod being supported in the said wings and sustaining one end of the said bars, combined with a removable hook or support for the other end. Sometimes a water back may surround the fire-chamber above the vertical gratings. Combined with the bottom or floor grating there may be a water back, consisting of a series of tubes surrounding or lining the wall of the furnace at the sides of the said grating, and provided with air spaces between them gradually diminishing in size towards the upper part of the furnace. Combined with a water back consisting of vertical tubes surrounding the furnace there may be a continuous chamber connected with the upper ends thereof, spaces being left behind and between the said pipes to admit air to the fuel.

By providing draught passages on all sides of the furnace extending above the main body of the fuel, a supply of heated air is afforded to unite with the gaseous products of combustion and thus cause the furnace to operate as a smoke and gas-consuming furnace. The upwardly extended portion of the grating may be supported at its upper end and have a free space behind it away from the fuel; or the bars may rest against the side walls, and should then have a long and narrow cross-section to produce air channels between the bars of considerable width measured from the fuel-supporting face of the grate bars to the face resting against the side walls. The vertical or upright grate bars are made tapering or broader at their upper than at their lower ends, to reduce the space for admission of air between them towards the upper part of the furnace. The floor grating is constructed to be readily lowered or turned aside as a whole, or in large sections, for withdrawing the fuel without having to remove and replace the separate bars. The water back may be sometimes a continuous chamber lining the furnace where exposed to the action of the fuel, and may sometimes be a set of horizontal pipes above the upright grating; and at the sides of the fire-chamber, instead of upright grate bars, there may be tubes through which water circulates in connection with a main water back. In the fire-chamber shown in one drawing, the front and rear portions of the grate are formed of curved bars, resting at one end on bearing bars, and extending therefrom a short distance horizontally to form with the centre part of the grate the bottom of the chamber, after which they curve upward and are supported at their upper ends by a cross bar, while upright bars form the other sides of the grate. Inwardly inclined refractory material, above these side gratings, is supported on ledges projecting from the metal casing of the furnace. The air, passing through the side gratings, cools them and checks the adhesion of clinker, while a poker may be here introduced to dislodge clinker.

[*Drawings.*]

A.D. 1882, February 11.—No. 662.

HEIDMAN, Gustav, and HOFFMANN, Yosef.—(*Provisional protection only.*)—Alloys.

A metallic packing for valves &c. is composed of two parts of manganese, two of phosphuret of copper, ninety-four of lead, and two of tin.

[*No Drawings.*]

A.D. 1882, February 11.—No. 672.

ABEL, Charles Denton.—(*A communication from Jules Laffitte.*)—Welding (including fusible metals, also nickel).

The flux employed, such as borax or sal-ammoniac, is formed into a flexible sheet so as to be applied perfectly to the entire surface to be welded, the sheet adapting itself to the configuration thereof. The flux is mixed with filings of the metal to be welded, and is then agglomerated under pressure into a sheet, which is placed between the two pieces to be united; the whole is heated sufficiently, and then subjected to blows or pressure for welding. A sheet of paper, metal, or other material, may be dipped into the melted flux so as to become coated therewith, and, after being passed between rollers to equalize the coating, is dusted over with the metal filings and then placed in a muffle to soften the flux and make the filings adhere; the passage between rollers is afterwards repeated. The said sheet serves as a temporary support for the layer of flux, but may be dispensed with when welding small surfaces. Metal sheets thus employed may consist "partly of iron and partly of "copper or nickel, whereby the welding of cast iron with cast "iron or with wrought iron or steel, or of nickel with nickel, "can be effected. The welding may also be effected with fusible "metals at the time of casting." In this case the part of the metal object to be united to the casting is covered with the sheet of flux, which is introduced into the mould, previously heated if needful, and the fluid metal is then run in. "The "molten metal imparts the requisite heat to the solid metal to "be united thereto to effect a perfect union."

[*No Drawings.*]

A.D. 1882, February 13.—No. 696.

CLARK, Alexander Melville.—(*A communication from Louis Clémandot.*)—Treating metals and alloys.

To treat or temper all kinds of metals and alloys, they may,

when at a sufficiently high temperature to ensure the necessary ductility, be subjected to hydraulic or other powerful compression and then allowed to completely cool under pressure, whereby the grain of the metal becomes finer and its hardness and density much greater. This treatment, applied to metals in course of manufacture, " will permit of the association " therewith of still larger proportions of substances by which " their properties are modified " as required. All the metals, including copper, zinc, gun-metal, bronze, brass, and nickel may be treated.

[*No Drawings.*]

A.D. 1882, February 13.—No. 700.

WILLIAMS, JOSEPH STOKES.—Metallurgical operations.

Means of generating, storing, regulating, distributing, and utilizing electricity for various purposes are described, including the construction of thermo-electric generators. Apparatus for generating and storing electricity in quantity is well adapted for the production and conservation of electric energy for heating and melting ores &c. in suitable retorts or furnaces. Also large bodies of metal in the form of furnaces &c. or parts thereof, can be constructed of two different metals or an alloy, provided with terminals, extensions, or parts, which provide for the thermo-electric currents being generated and conducted from the heated junction or parts of the thermo-electric elements. The last-mentioned furnaces may have a lining or encasement of firebrick &c. to prevent the undue heating or destruction of the metals forming the thermo-electric elements or pairs. By generating and utilizing thermo-electric currents, metals might be melted with electric energy derived from heat now wasted in industrial works.

There is a reference to the prior Specification No. 5233, A.D. 1881, which includes arrangements for heating rooms &c. by the aid of electricity.

[*No drawings.*]

A.D. 1882, February 17.—No. 777.

ABEL, CHARLES DENTON.—(*A communication from Hermann Alfred Schultz.*)—Recovering the tin from waste metals, alloys, &c., such as tin-plate waste.

A lye, preferably containing from 15 to 20 per cent. of hydrate of soda or potash or both, is heated to boiling with the addition of a considerable excess of an oxide of lead. By treating the tin-plate waste with the prepared lye, the tin can be dissolved without attacking any other metal present. A solution of stannate becomes formed, and the lead is precipitated as metal, the lye being employed until it becomes saturated with tin and no more oxide of lead remains in solution, whereupon the tin solution can be treated in the known manner. It should be cooled so that any remaining particles of lead or lead oxide may be precipitated. The lead is chiefly precipitated in a spongy state upon the metal underlying the tin, whence it can be removed as by scraping or washing. The treatment may take place in perforated drums, slowly revolving in the hot lye, the deposited lead being removed by the accompanying friction, and clean surfaces thus being presented to the liquid. The bye-product, consisting of oxide of lead and lead sponge, may be converted into oxide or otherwise disposed of.

[*No Drawings.*]

A.D. 1882, February 21.—No. 828.

FERRIE, William.—Treating blackband ores.

Part of the waste gases of blast furnaces may be employed for roasting, calcining, or carbonizing blackband and bituminous ironstones in close retorts separate from, *i.e.* not carried upon, the upper part of blast furnaces ; and thus is prevented the escape of the injurious fumes which result from open calcining or roasting in "bings," the carbonaceous matter in the ironstone being converted into coke, and the tarry and ammoniacal products being collected. Also part of the gases generated in the retorts may be burnt in surrounding flues to aid in heating them. The ironstone charged into the retort may be supported at its lower part by the calcined previous charge contained within a chamber, which is provided with a chain-band, receiving a continual slow or intermittent traversing motion from sprocket-wheels. Ridges on the chain-band gradually draw out the calcined material, and, the contents of the retorts sinking, room is left for fresh material. Again, the calcined material may be allowed to collect so as to seal the

lower ends of the retorts by placing a conical structure below their open bottoms. Or the retorts may have hinged discharging doors, which, when closed, are held in position by doors or props capable of being raised or lowered by screws to close and open the discharging doors. A group of retorts may be charged from a charging cone having a hopper or bell provided with divisions corresponding to the number of retorts to be charged. The blast-furnace gases, after being mixed with air for their combustion, are passed into flues around the retorts, and thence to a chimney ; or they may be further utilized.

[*Drawings.*]

A.D. 1882, February 21.—No. 846.

ELLIOTT, Robert.—Producing bars or rods.

The treatment of soft metal seems to be contemplated. Solid bars or rods of any desired section may be formed by apparatus analogous to that hereinafter described for making tubes, but in the case of solid bars "the core can be continued "only for a short distance, the die afterwards terminating in "a contracted passage of the size and form" of bar required : or "the core can be omitted and the passage through the die can "be of a serpentine form to give the necessary twist or helical "formation to the grain or fibre" of the bar.

To produce weldless tubes with the grain twisted to prevent longitudinal splitting, the molten or plastic metal employed is placed in a vessel with, at one end, a head-piece carrying a hollow hard metal die, in which are formed grooves in a helical or screw-like direction. Secured to the lower end of the vessel is a core or bar, which passes through the vessel and beyond the die, so that there is an annular communication through the die from the interior to the exterior of the vessel. On applying pressure, the metal is forced from the vessel through the die around the core in a helical course, and will issue therefrom as a tube. The vessel may be a fixture, and the head-piece be fitted to slide tightly therein, being in connection with the rods of hydraulic rams. As the head-piece is forced into the vessel, the metal will issue through the die. To rotate the die as the metal passes therethrough, the die may be made circular externally and with a bearing against surrounding antifriction rollers, and will then be rotated by the action of the passing metal.

But a modified arrangement is preferred, in which positive rotation is given to the die by means of a worm and worm-wheel, in connection with gearing for forcing forward into the vessel a ram or piston to which the core is attached. In another modification, the vessel is caused to move and the head-piece and core are stationary. The helical grooves may be in the core, as well as, or instead of, in the die, and the core may be rotated instead of the die. The tubes may be afterwards rolled or otherwise treated, the helical ribs being removed or not.

[*Drawings.*]

A.D. 1882, February 23.—No. 885.

BARLOW, Walter Alfred. — (*A communication from Charles de Vaureal.*)—Extracting gold, silver, and residual matters from sulpho-arsenical, sulpho-antimonial, and telluride or complex ores.

The ore, pulverized to pass through a sieve with about 3600 holes to the square inch, and thoroughly mixed with sufficient sulphide of sodium to form soluble sulpho-salts with the sulphides of arsenic, antimony, tellurium, and gold present (*i.e.* mixed with monosulphide of sodium equal to the weight of the antimony, tellurium, gold, and iron, to twice the weight of the arsenic, and to one-tenth of the weight of the gangue of the ore, and with one-fourth of the same aggregate weight of sulphur), is to be calcined without contact with air in a layer not exceeding 3 or 4 inches thick in a refractory gas-retort at a dull red heat. The retort is closed airtight except for the introduction of a rake for frequently stirring the ore mixture, a trap door being provided therefor. When the testing of samples indicates that the calcination or action on the ore is complete, the ore is discharged into cold water, without contact with the air to avoid decomposition of the sulpho-salts produced. The lixiviation, first in cold water and afterwards in hot with the addition of a little sulphide of sodium, dissolves sulpho-arsenite, sulpho-antimoniate, sulpho-tellurite, and auro-sulphide of sodium, while sulphides of silver and copper are left with the gangue of the ore. The solution obtained by lixiviation is passed through a filter, made of a mixture of fine sand and pulverized metallic antimony, which precipitates the gold as cement gold, mixed with the antimony of the filter and separable

therefrom by known means. To the filtered solution there is added commercial sulphuric acid ; and the arsenic, antimony, and tellurium are precipitated as sulphides, which are collected by filtration. The solution remaining is then evaporated to dryness, and a residue of sulphate of soda of commercial value is obtained. From the gangue containing the sulphides of silver and copper, these metals are extracted by known means, the prior treatment of the ore enabling a larger proportion of silver to be obtained and a superior quality of copper.

[*No Drawings.*]

A.D. 1882, February 27.—No. 955.

WIRTH, FRANK.—(*A communication from Heinrich Rössler.*) —Reducing and parting certain metals.

More particularly for reducing and separating gold, silver, copper, and lead, air is to be blown on or under the surface of the sulpho-metals whilst molten in closed vessels. Thus, concentrated sulphurous acid gases are formed and transformed into sulphuric acid, while the volatilized metal particles are collected in a condenser.

The sulpho-metals being melted in a closed crucible and the slag removed, air is exhausted by a blower from the crucible, and consequently fresh air is drawn into it through an opening in the cover, so as to impinge as a jet on the surface of the molten mass. The sulphurous acid formed passes through a cooling apparatus before reaching the condenser, which consists of a closed vessel, containing liquid and having a central pipe. Into the upper end of the pipe an air blast is forced, so as to draw the gases from the crucible through an ejector nozzle and propel them to issue through the perforated bottom of the pipe into the liquid and be condensed, the volatilized metallic particles carried away with the gases being blown into the condenser therewith. By the mutual action of the oxides formed and the sulpho-metals, very minute particles of metal are formed on the surface of, and descend in, the molten mass, arranging themselves according to its composition, and collecting on the bottom of the crucible. Gold is first separated, then silver and lead, and lastly copper.

[*Drawing.*]

A.D. 1882, February 28.—No. 969.

KAGENBUSCH, JOHN PETER.—(*Provisional protection only.*) —Extracting precious and other metals, including gold, silver, and platinum, from siliceous, aluminous, and other substances; and making aluminium bronze.

The substances are pulverized, roasted with carbonaceous matter like charcoal, thrown red hot into preferably cold water, well stirred, and washed clean. They are then dried and well mixed with fluxes for smelting, such as soda ash (carbonate of soda), potash (carbonate of potash), borax, lime salt, rock salt, fluor spar, &c., the silica and alumina chemically combined with the metals having to be brought into a soluble state. The mixture, after some days, is heated to whiteness in crucibles or furnaces, and melting takes place; the greater part of the metals present will thus be chemically separated from the silicious, aluminous, and other earthy and injurious substances. Afterwards zinc and copper are added, and the melted mass is stirred to cause a development of electricity, which facilitates complete separation of the metals from the other substances. The metals are next separated mechanically from the dross or slag by washing out the soluble matters, and are then purified as usual.

To the dross, when containing alumina, there is added metallic granulated copper; and on again melting with stirring, the copper will combine with the aluminium in the alumina so as to produce aluminium bronze of better quality than heretofore as it takes up all the gold, platinum, and silver left in the dross by the first process. The metal is mechanically separated from the dross and purified as usual.

[*No Drawings.*]

A.D. 1882, February 28.—No. 979.

ALLISON, HERBERT JOHN.—(*A communication from Evence Coppée.*)—Washing coal.

Arrangement of washing plant and construction of washers.

The coal is raised from a hopper by an elevator, and is delivered to a screen, from which the lumps pass through shoots to a set of washers, the small coal passing away through a suitable

channel. The screen may be kept clear by jets of water. The washed coal from each washer is delivered on to two vibrating sieves, and falls into hoppers, from which it passes through regulating slides into wagons. The schists pass through a separate channel. The small coal and water which pass through the sieves is collected in a channel, and, together with the small dry coal from the screen, passes to a classifier, and thence to a set of felspar washers, each of which receives coal of a certain size.

The water after use flows to clarifiers in which the slimes are deposited and discharged into a helix, which conveys them to a basin from which they are raised and mixed with the small coal. The clear water from the clarifier passes to a pump from which it passes to the different machines for re-use.

Motion is derived for the different machines from a shaft driven by an engine outside the washing house.

Each washer is formed of and lined with wood, and has a partition depending from the top to separate it into two compartments, one of which contains a piston, and the other a transverse perforated partition. The coal is admitted through a funnel-shaped channel over the transverse partition, and passes away, after being washed by the action of the piston, through an aperture extending across the front wall of the washer. The pure schist falls on to a sieve and forms a bed, which passes through an opening and slide into a trough, from which it is raised by a bucket-wheel. Above the pure schist is deposited a layer of coal streaked with schist, which passes through an intermediate opening and slide into a reservoir, from which it is discharged when desired. The fine schist which passes through the sieve collects at the bottom of the washer, and is let out through a valve into a channel leading to the schist basin. The movement of the piston should be a rapid descent with slow ascent and is given by a slotted arm.

A modified construction of washer is divided by a depending partition into piston and sieve compartments, and also laterally into three compartments, the third being smaller than the first or second. Each compartment contains a sieve upon which is a bed of felspar. The area of the washing surface should be somewhat larger than that of the piston. The pistons are actuated by eccentrics arranged with an adjustable throw.

[*Drawings.*]

A.D. 1882, March 3.—No. 1019.

MOUNTFORD, Charles James.—(*Letters Patent void for want of final Specification.*)—Fire-resisting bricks and blocks.

Asbestos and silicate of soda or potash and, preferably, fire-clay are thoroughly incorporated in a grinding or mixing mill, then moulded or shaped, and afterwards burned in kilns. The mixture in a semi-dry state may be moulded by pressure, or may be rendered plastic by moisture.

[*No Drawings.*]

A.D. 1882, March 4.—No. 1058.

MORRIS, James.—Producing aluminium.

An intimate mixture of alumina and carbon is to be heated to the temperature of ignition in a close vessel and subjected to the action of carbonic acid gas, whereby carbonic oxide is formed, and the alumina is more or less reduced to aluminium.

A very intimate mixture of alumina and carbon may be prepared by mixing a soluble salt of aluminium in solution, preferably the chloride, with powdered charcoal and lampblack, and evaporating, whereby the chlorine of the chloride of aluminium escapes as hydrochloric acid, and alumina is left to a large extent precipitated within the pores of the carbon. The resulting stiff plastic mass is formed into pellets, which should be porous to be easily permeable by the carbonic acid gas. The charcoal provides for porosity, while the lampblack allows a complete impregnation within its pores. Other aluminous and carbonaceous substances could be used. Carbon must be in considerable excess. The pellets are dried by air or by gentle heat: the little chloride of aluminium they still contain may be expelled by a current of steam in close vessels, externally heated enough to prevent condensation of the steam. Subsequently, after driving off combined water (the alumina being present as hydrate) and free moisture, they may be reduced in the same or other close vessels, such as tubes or retorts. They may be first ignited under exclusion of air or in a current of neutral gas; or the carbonic acid gas may be at once let in. The latter is reduced by the carbon to carbonic oxide, which in the nascent state is re-oxidized to carbonic acid by combining with the oxygen of the alumina, whereby it is reduced to

aluminium. Wrought-iron tubes, protected from the action of the fire, and of suitable size and shape for uniformly heating the pellets within them by gaseous fuel, are preferred : and the carbonic acid gas may be previously heated to further equalize the temperature, which should appear of a moderate red heat in the dark. Much carbonic oxide escapes reoxidation, and, as the amount evolved lessens as the carbon is consumed, the evolution of it in general indicates the progress of the operation, which should be stopped before the evolution becomes very weak, as some pellets retain their carbon longer than others, wherein the metal may be even burnt back to earth. Carbonic acid, intermixed with nitrogen owing to the mode of its production, may be used ; in any case it is previously dried. The metal is obtained in a spongy state, and may be freed by fusion (aided by mechanical means) from unreduced alumina and unconsumed carbon, and then run into ingots. The metal may be freed from combined carbon or other impurities by a method analogous to the Bessemer process of making steel, or by other purifying process. Fusion in separate vessels, with cryolite, chloride of sodium, or other flux, is preferred. To check oxidation or other loss of finely-divided metal, fusion or a preliminary sintering together of the metal may be made in a neutral atmosphere. No method of fusing the spongy metal or purifying it is claimed. Pellets retaining an objectionable amount of carbon may be again subjected to reduction.

[*No Drawings.*]

A.D. 1882, March 4.—No. 1063.

LAKE, Henry Harris. — (*A communication from Nelson Frederick Evans.*)—Extracting metals from their ores.

Chlorine gas is to be used under sufficient pressure to accelerate its action in reducing metals to the form of chlorides, and the uncombined gas is to be recovered in an undiluted state. The apparatus may comprise a chlorine gas generator, storage gasometer, receiver (in which gas may be stored under a pressure of 50 or 60 lbs.), exhausting-apparatus, pump, and chlorinator. The latter is like a barrel, revolving on trunnions and driven by a pulley ; a goose neck passes through one trunnion into the space above the charge. There are connecting pipes with cocks

or valves. The chlorinator being charged nearly full of ore and water, and being revolved about 20 times a minute, all air is exhausted from it and the gas passes into it from the receiver, thus subjecting the ore to a strong pressure for an hour or less. Afterwards the greater portion of the gas is passed from the chlorinator into the gasometer, and any gas remaining in the chlorinator is pumped into the receiver. The ore and water are then discharged from the chlorinator, the ore is filtered, and the gold precipitated and collected as usual.

Again, into the chlorinator, charged with ore and water, there may be introduced chloride of lime and afterwards dilute sulphuric acid, whereupon a large excess of chlorine gas under pressure is evolved, rotation being continued for from half an hour to three hours, when chlorination is complete. Rotation during chlorination hastens the chemical reaction. The chlorinator is now tapped, and the excess of chlorine may be drawn off into a gasometer, if any, or passed into the air. The contents of the chlorinator are emptied into a vessel, and the metallic chlorides collected as usual.

[*Drawing.*]

A.D. 1882, March 11.—No. 1193.

LAKE, William Robert.—(*A communication from Theodore Augustus Blake.*)—(*Provisional protection only.*)—Stone and ore crushers.

Improvements on the Blake crusher. A vibrating jaw (to which power is applied) and a stationary or resisting jaw are combined with one or more jaws hung between them upon axes parallel to that of the vibrating jaw. The space between each jaw and the next corresponds to the usual opening between the jaws of the Blake crusher; and material placed between the vibrating and the next swinging jaw will communicate the swinging movement of the vibrating jaw to the second, the second to the third, and so on towards the stationary jaw, which forms the resistance for the last swinging jaw, and each swinging jaw for that next in rear of it. A longitudinal stationary rod passes through arms extending down from the jaws, a screw-threaded rod is provided, and in the rear of each arm are adjusting or set nuts which form stops for the rear movement of the jaws, while each arm bears against a spring in its forward

movement. If the delivery mouth between the jaws is to be one-eighth of an inch and the movement of each jaw also one-eighth, the mouth between the jaws in their normal condition will be one-fourth and the movement of the first jaw or the stroke of the machine will be three-eighths of an inch. The resistance being ordinarily the same between all the jaws, the first jaw will move three-eighths, carrying the second jaw two-eighths, and the third jaw is forced one-eighth ; but if too hard a substance to be crushed comes between either of the jaws, the full movement of the one jaw will be communicated to the other, which will be carried one-eighth nearer its next (or the stationary jaw) and will so work until the obstruction is removed. Or "one jaw will remove a little nearer than another "jaw than before," dividing the space between the then working mouths. In such cases the extra resistance between any two working surfaces is taken up by the others, instead of something breaking or giving way. The capacity of the machine over a single vibrating pair increases with the number of intermediate jaws, a three-fold amount of work being done with two intermediate jaws.

Sliding jaws with inclined working faces may replace each or all of the vibrating or swinging jaws, power being applied to the extreme movable jaw.

[*No Drawings.*]

A.D. 1882, March 15.—No. 1264.

LAKE, WILLIAM ROBERT.—(*A communication from La Société Oeschger Mesdach & Cie.*)—Heating zinc furnaces.

Gas from a generator is to be burnt gradually and regularly at several places in peculiar combustion chambers, so as to obtain in each a uniform temperature, *i.e.* that most suitable for reducing zinc ores. The heating is effected under a chimney draught, and the gas does not require a special regenerator of heat. The quantity and temperature of the air introduced into each combustion chamber are regulated. Cold air, in thin flat jets or sheets and in moderate quantity, is admitted where the gas enters the furnace, and burns it in long flames at a moderate temperature to envelop the crucibles or muffles. Along the passage of the inflamed gas and in the other combustion chambers, where the further burning of the gas is to take place

successively, and to continue the production of long flames, there is introduced, gradually and in suitable quantities, air more and more highly heated as the combustible quality of the gas diminishes. The air inlets are so arranged that jets of flame may not be directed against the crucibles. The air may be heated by the waste heat or otherwise.

Two ordinary "Liegeois" furnaces, placed back to back, and having, say, two combustion chambers may be used. The gas channel is enlarged to spread the gas into a sheet in the first combustion chamber. Cast-iron boxes with slides regulate the first admission of cold air, which is distributed in sheets by numerous openings. Long flames rise, envelop the crucibles in this chamber, and, passing by an opening at the top of the partition wall, descend into the second chamber. Air, highly heated by traversing channels or flues, is distributed by other openings, so that the same temperature as in the first chamber may be here maintained by complete combustion. The products of combustion pass by outlet openings into a chimney flue.

Another arrangement is for a furnace with one face, composed of four compartments each with a special combustion chamber, the first and third being heated by ascending and the second and fourth by descending flames. There are passages for the flames between the different compartments, and air inlets for each. The furnace may comprise five rows of six crucibles each. The cells or cases of the front corresponding to the sixth row are closed by a front plate of firebricks, allowing access to the passage orifices and to the inlets for air. The use of cold air in the first part of the furnace allows the colours of the flames to be seen in the admission channel by orifices, the state of the gas generator being thus ascertained.

Again, in a long furnace with one face divided into several compartments by vertical partitions, the flames take a horizontal course, passing through orifices in the partitions; and the compartments form successive combustion chambers, air being distributed as above described.

[*Drawing.*]

A.D. 1882, March 17.—No. 1305.

WATSON, David.—Purification of copper precipitate and ores, and production of commercial arsenic and phosphorus compounds.

To remove arsenic, phosphorus, chlorine, and tin from copper precipitate obtained in the wet extraction of copper, the precipitate is treated with a solution of alkaline (sodium or potassium) sulphide aided usually by heat. A proportion of 20 per cent. of sodium sulphide will generally purify any variety of copper precipitate, which, after washing and drying, is then ready for smelting. Copper ores, containing arsenic or chlorine, or both, as arseniate or arsenite of copper and oxychloride of copper, when ground, may be likewise purified from arsenic and chlorine.

Sometimes solutions of alkaline hydrates (caustic alkalies) or carbonates may be the purifying agents employed. The solutions produced in the processes, when containing arsenic and phosphorus compounds, are available for preparing commercial arsenic and phosphorous compounds.

[*No Drawings.*]

A.D. 1882, March 22.—No. 1399.

BURCH, Joseph, and EVANS, William.—Furnaces.

The direct course of the flaming gases passing through a reverberatory furnace or refining chamber may be interrupted by a low arch, extending across the middle from side to side, and either made solid up to the roof, or in the form of a bridge so that there will be passages for the gases above and below the bridge respectively. The upper surface of the bridge may have a shallow trough-like recess, answering as a crucible for heating and melting a charge of metal, which afterwards runs down through a channel (controlled by a plug which is introduced by means of a hole from the outside) on to the hearth beneath for further treatment. There are dampers to shut the draught-way over the bridge while a fresh charge is being introduced through a door in the roof. These dampers also regulate the amount of heat passing respectively over the bridge, and under it through the hearth chamber, wherein one charge is treated while another is being melted in the said crucible.

The invention also relates to oscillating puddling-furnaces &c.

[*Drawing.*]

A.D. 1882, March 27.—No. 1471.

LEY, William Vawdrey.—Alloys for stuffing-box packing.

Grains of white metal are incorporated in a plastic mixture. The composition proposed is antimony 1½, block tin 2, lead 3, and zinc 8 parts by weight.

[*Drawing.*]

A.D. 1882, March 28.—No. 1484.

GARDNER, Clement Sankey Best.—Tin-plates.

A spray of water is directed upon the plate immediately after it issues from the rollers and whilst the tin upon it is still molten. The plate thus chilled is afterwards dipped in an acid solution and crystallization is thus produced upon it.

[*No Drawings.*]

A.D. 1882, March 29.—No. 1507.

BOWEN, Thomas, and JENKINS, Esau. — (*Provisional protection only.*)—Calcining-furnaces.

For calcining ores, &c., there may be employed the following furnace which is described with reference to annealing :—To more equally diffuse the heat for the even and rapid heating of annealing pots or vessels, the ashpit of the furnace is enclosed by doors and an artificial draught is used. By placing a boiler between the furnace and the stack, steam may be raised to work the fan, steam jet, or other blower ; or the draught may be supplied independently. A damper in the stack assists in regulating the heat. For calcining, the details are "modified "accordingly."

[*No Drawings.*]

A.D. 1882, March 29.—No. 1533.

AITKEN, Russel.—Extracting gases from molten metals (and other materials).

This may be readily effected, to improve the quality of the metal for treatment, by passing it, while molten, in streams, spray, or an equivalent divided state into or through an airtight closed space, ladle chamber, or vessel, wherein a vacuum or partial vacuum is maintained by connection with an air pump or exhauster. The molten metal may gradually pass in a thin

stream into the said vacuum vessel from a receptacle, the passage between the two being fitted with a valve or plug, the opening of which allows the metal to pass. Thus, not being subjected to pressure on any side, the metal will be most favourably conditioned for the escape of occluded or enclosed gases; and it may strike against a projection or disperser, to break it up and aid the action. The gases are conveniently drawn off by the exhauster for condensation or other treatment. The treated metal may solidify in the vessel, or be drawn off by a tap-hole and run into moulds; or, on removing the cover, the vessel can be employed as a ladle as usual. The vessel may have a plugged opening at the bottom, and the plug may be forced out by the weight when a head of metal is attained in the vessel. Then as long as the supply of untreated metal lasts, a continuous outflow of treated metal will result. Again, the vacuum chamber or vessel may be placed above or beside the receptacle containing the metal for treatment; and, on making a connection by a pipe or otherwise, the molten metal will be driven into the vacuum chamber by the pressure of the atmosphere. By placing this chamber upon the said receptacle, and using a connecting pipe opening from the bottom of the chamber into the molten metal for treatment, and alternately exhausting the air from and admitting it into the chamber, the metal may alternately be forced into this vacuum chamber and run back into the receptacle; the process being rapidly repeated until the metal is sufficiently free from gas.

If requisite, nitrogen or other gas may be admitted and also exhausted, so as to reduce the proportion of oxygen in a partial vacuum to a non-explosive amount. Substances may be introduced into, or gases passed through, the partial vacuum chambers, if beneficial to the quality of the metal treated.

[*Drawing.*]

A.D. 1882, March 31.—No. 1568.

RENDER, Frederick.—(*Provisional protection only.*)—Firebricks &c.

Firebricks and other articles, formed of clay or other suitable material, may be manufactured better able to withstand high temperatures by intimately mixing the crushed or ground clay or other material with silica, previously dissolved or

brought to a gelatinous state by known means. Mixing may take place in a pug mill or other apparatus, water being added if needful; and afterwards the mixture may be moulded and made into bricks &c. as usual.

[*No Drawings.*]

A.D. 1882, March 31.—No. 1576.

BARLOW, WALTER ALFRED.—(*A communication from Louis Bourau.*)—Recovering tin from tin-plate scrap &c.

To completely separate the tin from the iron, without any salts of iron becoming mixed with the salts of tin, the scrap is treated in a rotating cylinder with chloride of tin and a slight excess of hydrochloric acid beyond the quantity required to convert the tin under operation into chloride. A steam vessel within the cylinder provides for heating the liquid. When all the tin is dissolved, the chloride of tin is run off through a tap into a reservoir beneath, and the iron is afterwards discharged through a door. The chloride of tin may by treatment with water be converted into oxychloride, which, after filtration and usual treatment, may be fused with charcoal to obtain chemically pure tin. Or the chloride of tin may be treated with zinc. " The tin then put free in the chloride of zinc is " collected and freed from the acid which it is mixed with, " then either by heat or by energetic pressure it is melted in a " convenient oven."

The wooden or copper cylinder employed rotates on two hollow trunnions, the trunnion ends communicating with its interior. Along its whole length is a door, kept closed by a copper band and pressure screw, while an india-rubber hinge makes it steam-tight. On one side of the cylinder is a pipe, in connection with the heating apparatus and terminating in a polished copper collar piece; which is supported by a projecting piece set completely up to the trunnion end, a spiral spring securing the perfect contact of the collar piece and projecting piece. The trunnion end carries a tube, communicating with a lentiform vessel placed at its end. The rotation of the cylinder will not prevent the perfect communication of the steam. The other trunnion end is likewise fitted with pipes, one of which, shown in a drawing as within the cylinder, " is set vertically " and is always in place at the top of the cylinder." Three

branch pipes with cocks are in communication. The first allows the gases and vapours to escape during the operation, there being a condensing column for collecting the acid vapours. The chloride of tin or hydrochloric acid may be introduced through the second branch ; and the third serves for washing the iron in the cylinder, if desired.

[*Drawing.*]

A.D. 1882, April 1.—No. 1591.

LAKE, HENRY HARRIS.—(*A communication from Edward Wilhelm.*)—Manufacture of starch.

This invention relates, *inter alia*, to apparatus for washing starch and like materials. A vertical shaft within a washing-tank carries agitating-arms and is arranged so that it can be raised or lowered as required, the bottom of the tank being provided with a conical or other shaped recess into which the lower end of the shaft passes as it moves down. Attached to the shaft is a rack plate, so fixed that the shaft is free to revolve in it, but that both move together vertically. This rack plate moves in vertical guides, and gears with pinions by which a vertical motion is imparted to it. A screw may be used in place of the racks and pinions.

The agitator being raised, the material is run in and allowed to settle, the clear liquor being run off and water added. The agitator shaft is then set in rotation and gradually lowered till the whole is well mixed. This operation is repeated till the material is thoroughly washed.

[*Drawings.*]

A.D. 1882, April 1.—No. 1594.

HUGHES, Sir WALTER WATSON.—Smelting copper and other ores, and reverberatory furnaces therefor.

A reverberatory melting furnace, say 15 feet long and 10 broad, is connected by a downwardly-inclining flue with a reverberatory collecting-furnace having a deep bed. The fire-bridge of the melting-furnace rises only a few inches above the bottom, and the roof of the furnace is low. The bottom which is slightly hollow between the sides of the furnace inclines from the firebridge towards the entrance of the flue opposite to the

bridge. The metal and slag as they melt in the melting furnace run through the flue into the collecting furnace, which has its separate fireplace and is connected by another flue to the stack. Both furnaces are raised to a white or smelting heat. Two tons or so of dry ground ore being charged into the melting furnace with fluxes, in less than an hour the metal and slag will run into the collecting furnace, and the melting furnace may be recharged. When the slag, which is free from copper, has reached the level of the skimming plate, it is run or drawn off from the collecting furnace. When the metal is level with this plate, it is tapped off as usual. The metal and slag flowing down the flue between the two furnaces may drop into basins or pockets, and they are met by blasts of air issuing from openings in hollow bricks at the entrance end of each basin. The metal remains for a time in the basin, while the air blowing into it rapidly oxidizes the sulphur present. The slag may rise high enough to reach an opening in the roof of a tunnel beyond the collecting furnace, and falls into trucks standing in the tunnel to receive it. The products of combustion from the melting-furnace may be led away to the stack without entering the collecting furnace.

[*Drawing.*]

A.D. 1882, April 4.—No. 1625.

COWPER, Edward Alfred, and SOPWITH, Thomas.—Recovering lead and other metallic substances from furnace fumes.

The inventors refer to their prior Specification No. 2807, A.D. 1880, and also to their "Patent dated 1st February, 1881."

Diaphragms of porous fabric, preferably fibrous like flannel, are arranged horizontally or inclined, so that the fumes being brought beneath the fabric, the gases may pass upwards through it, and the solid matters becoming deposited against the underside of the fabric may drop by gravity on to the floor of the containing flue or chamber. The upward current is very slowly passed through a very large extent of fabric so that the latter shall not become choked and the natural draught of the chimney will suffice. The apparatus is preferably at a distance from the furnaces, so that the heat of the fumes may become reduced;

but ordinary means of cooling may be also used, or cold air may be mixed with the fumes. There should be a considerable depth of flue or chamber beneath the fabric, so that the deposit need not be frequently removed. When doing this, a damper in the main flue is opened and those in the branches leading to and from the apparatus are closed. The side edges of the sheets of fabric may be attached to the side walls of the chambers (a set of which may be used), and their middles may be attached to bars suspended from the crowns of the arches over the chambers, while their intermediate folds are weighted down by other bars lying in them. Thus a large surface is exposed, and the velocity of the fumes is much reduced owing to the large area of passage in the set of chambers. The bars supporting the middles are attached to handles, extending outside the chambers, and capable of being raised and lowered to shake the fabric in the event of deposited matter clinging thereto : or a lateral movement may be given by cranked spindles.

The fumes may be treated, in accordance with the prior Specification, before reaching the porous fabric.

[*Drawing.*]

A.D. 1882, April 4.—No. 1627.

TILLETT, BENJAMIN.—(*A communication from Erastus S. Bennett.*)—" Separating metallic and other bodies from calcareous " and other earths."

For separating gold and other metals from earths, a portable machine is employed, the body of which has springs between it and the travelling wheels. Pulverized quartz or other earth is dumped on an inclined grate, so that the larger stones slide off at its lower end out of the way. The " pay dirt " and stones, passing through this grate, drop into a hopper and thence pass into a feeder, provided with flights to carry the material into a revolving double - meshed cylinder or grate with which the feeder revolves. Owing to the partial submergence of the revolving cylinder in the water of a main tank, the material drops into water instead of directly on to the screen of the grate and while screening proceeds, each particle is being washed, clay is being broken up and dissolved, and the water which rushes in at one side lifts and loosens the material, while that

which is rushing out at the other carries the pay dirt out into the tank. Also the direction of these ingoing and outgoing waters is constantly changed with reference to the screen, which prevents the wedging of particles in the mesh. The material is carried over the surfaces of the double grate by means of archimedean screws inside the coarse grate and between it and the fine grate composing the cylindrical grate. The washed refuse, on reaching the discharging end of the cylinder, is lifted up and thrown out by suitably shaped pieces of metal. The interior of the tank is lined with amalgam plates, corrugated preferably to form steps from top to bottom where there are, say, two V-shaped valleys : or the tank may be of other shape, but it should have an inclined or angular bottom with valleys. In the bottom of each valley, water jets of considerable force are arranged in a line to throw streams of water upward to the surface of the water in the tank ; they have also a slightly forward inclination, and are pointed alternately a little to the right and left. The material washed out of the cylinder drops through the water on to the amalgam steps. Owing to the jarring motion of the steam engine of the machine (and to notching the collars on the cylindrical grate, so that a vertical jarring can be imparted to the tank), the material drops from step to step till it reaches the bottom. Then the first jet projects it upward, forward, and slightly to the side, so that it is deposited again on the steps, but a little further forward ; and this process is continued until it reaches the other end of the machine, when the last few jets throw it into a tailing tank through openings between the two tanks. Thence it is taken up, preferably by the buckets of a rotating tailing wheel, and discharged by a shoot as fine tailings. The jets throw preferably round columns of water : they can be combined to form sheets of water The revolving grate can be square or many-sided in cross section, and can receive a continuous, intermittent, or reciprocating rotary motion. The engine may operate the several parts by means of shafts, worm gearing, chains, and sprocket-wheels ; and the machine can be provided with pumps. The chances of amalgamation for each particle of gold are very numerous as compared with the "two chances" given by a stamp mill ; and, owing to the scouring in the cylindrical grate and by the jets even rusty or coated gold will be cleaned so that the plates may lay hold of it.

[*Drawings.*]

A.D. 1882, April 6.—No. 1690.

GILCHRIST, PERCY CARLYLE, and THOMAS, SIDNEY GILCHRIST.—(*Provisional protection only.*)—Manufacture of nickel.

Into melted crude nickel pig (in which nickel exists in combination with carbon and more or less iron &c.) there may be injected currents of air until all the iron and other impurities are oxidized. Either a gas furnace with one or more tuyères or an apparatus like a Bessemer converter with side or bottom tuyères may be used with a siliceous or lime or magnesian lining. Lime, silica, or the like may be added to form a fusible slag with the oxides produced. Thus, fused metallic nickel may be produced at a reduced cost. Manganese or an alloy thereof or other highly oxidizable body may be added to the nickel before casting to render it more malleable.

[*No Drawings.*]

A.D. 1882, April 8.—No. 1700.

JOHNS, THOMAS HENRY.—Galvanizing sheet iron.

The plate to be galvanized is delivered by rolls to a bath containing the molten metal and flux, the latter being retained at the feeding end of the bath by a flap descending into the bath. The plate is pressed along the bath, and up a slope, beneath a flap to delivery rolls ; thence between planishers and through a second set of delivering rolls. The bath is provided with a cover and is heated by furnaces or by gas or other suitable means ; the first pair of delivering rollers are hollow, and heated by gas or otherwise ; the second pair of rollers are also hollow, and cooled by air, water, or otherwise. Both pairs of rollers are carried in sliding bushes, and the distance between them can be regulated by levers and screws. The distance between the planishers can also be adjusted as required, and a sideways reciprocating motion can be given to them. In place of the rollers, small rollers or discs, fixed in such a way that they can grip the plates by their edges, may be used.

The plates when delivered may be passed to corrugating or stamping machinery, which may be mounted on an extension of the standards, and driven by the machinery which works the rolls.

[*Drawing.*]

A.D. 1882, April 11.—No. 1716.

BELL, Thomas, junior, and RAMSAY, William.—Washing minerals &c.

Coal or other mineral is fed from a hopper into the upper end of an inclined semi-cylindrical trough, carried at its upper end on an axis, and suspended at its lower by chains and balance weights: a stream of water is directed along it. An axis, carrying arms or stirrers, passes along the trough from end to end; it is carried in bearings upon the fixed frame of the machine, and receives a rocking movement so that the stirrers keep the contents of the trough in motion. Ledges or stops within the trough, but carried by the frame, prevent the heavier matters which descend to the bottom from passing onwards along the trough. The stops are semicircular and of sheet iron. Around the edge of each there is riveted a strip of india-rubber, leather, or other pliable substance to make the stop tight in the trough and prevent particles from passing underneath. The lighter material is carried down the incline by the water and passes to a delivery shoot. When the spaces behind the stops have become nearly full of the heavier matters, the supply of mineral to the trough is stopped, and when the delivery at the lower end has ceased, the trough is lowered away from the stops and stirrers and the heavy matters slide freely down it into another receptacle. The trough might be V-shaped in cross section.

[*Drawings.*]

A.D. 1882, April 13.—No. 1750.

BURR, Walter.—(*Provisional protection only.*)—Manufacture of sheet lead.

The sheets are cast of almost the thickness required. A travelling crucible may be like a truck or wagon, mounted on rails or guiding surfaces on or over a casting bed or table, one end of which communicates with a furnace, and the other with rollers for receiving and finishing the cast sheets. The furnace has a horizontal platform in the same plane as the casting bed, so that the crucible may be run to and from the interior of the former. The crucible, which may receive molten metal from a stationary crucible or cupola, or in which pig

metal may be melted, is made with a subsidiary compartment having a false or adjustable bottom, access to which is controlled by a conical or other valvular or equivalent device, so that the molten lead, allowed to pass from the main compartment to the former, is caused to flow upon the shallow recessed surface of the casting bed in a thin film to the required thickness. The false bottom may consist of an adjustable plate, so as to leave any desired aperture for the egress of the molten metal. In front of the crucible is mounted a roller or equivalent device ; it is capable of angular or other adjustment and, being always heated and moved with the former over the sheet during casting, imparts thereto a smooth and polished surface. Other means of applying heat to the upper surface of the sheet may be adopted. Conversely, air or water may circulate through the casting-bed to cool the metal at the proper place and time, ready for reception of the rolling apparatus whereby homogeneousness and finish of the lead is obtained.

[*No Drawings.*]

A.D. 1882, April 13.—No. 1763.

BULL, HENRY CLAY.—Calcining apparatus in connection with blast furnaces, and refractory material.

1. A calcining chamber or oven, lined with firebrick or equivalent, is erected directly over the charging opening of the furnace, this opening being fitted with a bell and cup, supplied with water jackets to protect them from heat. Air enters by openings at the lower part of the oven ; and, during the calcination of the iron ore, the bell is slightly opened to admit sufficient gas from the furnace for combustion just above the bell and cup. The oven is open at the top for feeding the charge, and for the escape of aqueous vapour given off during calcination ; and thus the ore and flux will enter the furnace in a dry heated state.

2. To form the crucible of the furnace, between a casing or outer shell and an interior metal mould of the shape of the crucible, the inventor rams a concrete compound of freshly burnt lime, or any substance possessing the same properties, with about 10 p. c. of silica sand, mixed with tar, oil, or other substance which will evaporate and escape through openings in

the casing without the lining shrinking or cracking. This lining is so intensely heated as to melt out the inner metal mould, and is thereby baked into a very solid substance, which will withstand the most intense heat but will support very little weight.

[*Drawings.*]

A.D. 1882, April 15.—No. 1808.

TURNOCK, Joseph Rushton.—Pickling and washing metal plates.

The pots containing the pickle and water are carried in a frame, hung from centres, so that the pots may be oscillated by a crank or otherwise to agitate the liquid. The plates are placed in rack carriages, supported on wheels running on rails. Portions of the rails over the pots form parts of cages suspended from chains, which may be actuated by hydraulic or steam cylinders and balance weights, to lower the carriages into or raise them out of the pots. The cages are prevented from swinging by guide rods, and carry upper rails, which, when the cages are down, may be brought into position to return the empty carriages to the loading rail.

[*Drawing.*]

A.D. 1882, April 17.—No. 1821.

MEWBURN, John Clayton.—(*A communication from Lazare Weiller.*)—Manufacture of siliceous copper and bronze.

Such compounds are suitable for making electric conducting wires. To produce them economically, instead of adding silicium to copper and also adding sodium to prevent oxidation during casting, substances, capable of furnishing in the midst of molten copper or bronze the requisite silicium and sodium to produce the siliceous alloys, are to be introduced into the molten metal. Into a plumbago crucible, containing about 10 kilogrammes of copper (with about from 20 to 450 grammes of tin in the case of bronze), there may be introduced from 100 up to 2000 grammes of the following mixture according to the degree of conductivity required in the wire :—fluo-silicate of potass up to 450 grammes, pounded glass to 600, chloride of sodium to 250, carbonate of soda to 100, carbonate of lime to 120, and dry chloride of calcium to 500. Additional fluo-silicate

of potass may replace the glass and chloride of calcium. The mixture, having been raised to a temperature approaching that at which the different bodies can enter into reaction, is thrown into the hotter melted copper or bronze: thus the reactions are produced, and the silicium and sodium in combining with the metal absorb all the oxides present. A little carbon is a useful addition towards the end of the process. The chloride of calcium absorbs the scoriæ as they are formed. When the reactions are finished, the alloy is run into bars to be drawn into wires of much electric conductivity and strength.

[*No Drawings.*]

A.D. 1882, April 17.—No. 1826.

BARLOW, Walter Alfred.—(*A communication from John Leonhard Seyboth.*)—Treating metals and alloys.

Purification and improvement may be effected by adding to molten metals and metallic compounds certain salts, mixed with charcoal, cellulose, or paper pulp, and from these salts their respective metals or metalloids are formed in the melting heat of the metals treated. The purifying process is varied according to the metal or metalloid to be employed: thus—

(*a*). Commercial potash is steeped with cold water, and the solution, after filtering and boiling down, is mixed with fresh powdered charcoal in proportion of one quarter by weight of the potash. The mixture is gently heated till a thick paste is formed, which may be compressed into blocks or bars, each preferably weighing about 0·4 lb. to serve as addition for 20 lbs. of metal or metallic composition; or the mass may be ground to powder and used in packages of proper weight.

(*b*). Anhydrous soda (carbonate of sodium) may replace the potash. The potash or carbonate of sodium, under the melting heat of the metal treated, loses its carbonic acid; and the heavier layer protects the metal against the lighter oxygen of the air, which otherwise it would absorb. Part of the carbon reduces the oxides in the metal, while another part decomposes the oxide of potassium or of sodium, and kalium or natrium in the nascent state combines with the deoxidized metal. The potash and soda may be replaced by the corresponding supertartrates, which are carbonized and mixed with charcoal.

(*c*). Hydrophosphate of calcium, as obtained from animal charcoal, is mixed with charcoal. Of the dried product, 0·68 part by weight may be used to 10 of the metal treated, which in this case will afterwards contain 1 p. c. of phosphor. The mixture must be heated or roasted to obtain non-deliquescent metaphosphate of lime from the hydrophosphate of calcium; or phosphoric acid may be used. The phosphoric acid is reduced by the carbon. Thus phosphuretted metal is obtained, without producing by an expensive process a high-grade phosphuret of copper or tin and using the same for phosphuretted compositions.

(*d*). Protoxide of chromium, mixed with one quarter by weight of charcoal, is reduced to chrome.

(*e*). Protoxide of manganese, likewise treated, is reduced to manganese.

(*f*). Fluo-silicate of potassa is mixed in equal proportions with the finished kalium mixture; and the kalium obtained therefrom combines with the fluoride of potassium, in place of the silicium of the said fluo-silicate.

(*g*). Boracic acid and phosphoric acid in equal quantities are mixed with one-fourth part of charcoal and treated: the phosphoric acid is first by the carbon reduced into phosphor, which as such in the nascent state reduces the boracic acid into boron.

Likewise any metal salt, reducible at the melting heat into an easily oxidized metal as above described, can be used for forming alloys.

Balls or packages of one of the compounds may be placed in a pan or shell with perforated bottom and sides (the cut-off bottoms of old crucibles being preferred), and the pan is placed at the bottom of the crucible employed with the pieces of metal to be melted on top. The metal melts, and the pan, now containing all the residue and impurities, rises to the surface and may be lifted or skimmed off automatically by a knife blade or ladle, thus leaving the metal quite pure.

[*No Drawings.*]

A.D. 1882, April 17.—No. 1831.

RIPLEY, ROSWELL SABINE.—Reducing and purifying metals directly from their ores.

The pulverized and preferably heated ore with a proper admixture of fluxing and purifying materials may be introduced at a regulated speed through a funnel inserted in a covering tile, which closes the upper end of a cylindrical tube provided with blowpipes or burners. The burners are inserted in orifices, so arranged that each flame is inclined towards the axis of the tube and is met by a similar flame from the opposite side, the resultant flames being forced downwards along the said axis. Thus the powdered ore &c., will descend through an intense flame formed by the concentrated flames of the different burners, and will be kept therein by the currents. The powder quickly melts, and the product will fall into a subjacent reservoir, heated by the prolongation of the flames and by burning more gas therein, and provided with upcast outlet flues for the products of combustion, the waste heat of which can be utilized for the process. In a tube of limited length, one or more sections may have burners inclined upwards to retard the descent of the metal and detain it in an enlarged reverberatory space, formed where the ascending and descending flames meet, and fitted with outlet tubes and valves or dampers to regulate the escape of gaseous products. Or, with a like object, the sections may be arranged in steps connected by inclined conduits ; and, to maintain the heat while the metal is flowing along the conduits, blowpipes can be inserted at the angles where the conduits join the tubes, so that flames may flow through the conduit in either direction. The molten metal in the reservoir can be treated according to the product required.

The said blowpipes are so arranged that gas and air can be delivered at the point of combustion in each burner in proportions to produce either oxidizing, reducing, or neutral flames as required in the different sections. According to a drawing, the main tube and its refractory lining are perforated by inclined air tubes leading from annular air chambers, through which gas burners (in connection with gas chambers) pass into the air tubes. The supply pipes have stop cocks for regulating the supplies of gas and air to the different sets of blowpipes, and there are valves to control the pressure. The gas preferred is made by the decomposition of water by incandescent carbon, and so consists of carbonic oxide and hydrogen, which powerfully reduce and purify.

[*Drawing.*]

A.D. 1882, April 19.—No. 1884.

LAKE, William Robert.—(*A communication from Eugenio Marchese.*)—Separating metals and metalloids from ores &c., by electricity.

The metalliferous ore or product may form the anode (positive electrode) of an electrolytic bath, traversed by an electric current; and undergoes an oxidizing action by the decomposed electrolyte. In the vessel employed may be placed narrow boxes or compartments, the lateral walls of which are of cloth, and which are fitted with galena (when this ore, composed of lead and sulphur, is to be treated) in pieces, grains, or slich. Metallic conducting bars bear upon the upper surface of the galena, and are connected to the positive pole of the dynamo-electric or other machine. Thus the galena constitutes the anode. Plates of lead or other suitable conducting material, suspended between the boxes of galena, are connected to the negative pole of the machine and form the cathode (negative electrode). A solution of nitrate of lead, used as the electrolyte, fills the vessel nearly up to the top of the galena. The current, traversing the bath, decomposes the nitrate of lead: the lead deposits upon the cathode, and the acid radical (nitric acid + oxygen) attacks the lead of the galena to reproduce nitrate of lead, and so on. If the electromotive force be regulated, the sulphur of the galena will remain at the anode while there is lead to be attacked, and may be separated by distillation from gangue, if present. The lead deposited on the cathode is collected at intervals, and washed, remelted, or pressed. Also acetate of lead may be the electrolyte employed. As regards the number and size of the vessels and of the boxes of galena in each vessel, the vessels must be arranged in tension sufficiently to reduce the electromotive force to the number of volts necessary for the chemical reaction of the dissociation: and the derived or branch circuits and the surfaces of the electrodes should be such as to reduce the external resistance of the circuit to the most favourable quantity. Only the electromotive force absolutely necessary for the dissociation is to be employed; and in the attack of the anode, part of the force is furnished by the attack itself. Copper ore or sulphuret of copper can be likewise treated by using sulphate of copper as the electrolyte, blende (sulphuret of zinc) by using sulphate of zinc, pyrites (sulphuret of iron) by using sulphate of iron,

and all other ores and sulphuretted products, which conduct electricity, by using a suitable electrolyte. The metal will be obtained at the cathode, and the sulphur remain at the anode. Poor sulphuretted ore should be fused without roasting so as to eliminate the gangue as scoria and concentrate the metals and sulphur in a mass for treatment.

Separation of metals may be effected if the ore contains more than one. Thus, in treating argentiferous galena, using nitrate of lead as the electrolyte, the lead is obtained upon the cathode, while the silver, which remains at the anode with the sulphur, gangue, and a little lead, may be passed to a cupel or subjected to fusion (after separating the sulphur by distillation). Here it is the lead which combines with the acid radical, since the formation of nitrate of lead liberates more heat than that of nitrate of silver. A like separation can be effected by using acetate of lead as the electrolyte, on the principle that the acid radical of this electrolyte cannot combine with one of the metals to be separated (silver). By treating iron pyrites containing copper, and using sulphate of copper as the electrolyte, and copper plates as the cathode, all the copper of the pyrites may be deposited at the cathode without any iron. The bath becomes gradually saturated with sulphate of iron, whereupon carbon may replace the pyrites as the anode, and the copper in the bath be wholly precipitated. Then the solution of sulphate of iron may be removed and utilized, or the action of the electric current may be continued to obtain pure metallic iron and sulphuric acid for further use. Again, by continuing the original operation after the bath has become saturated with sulphate of iron, the iron of the pyrites will be no longer attacked but all the copper is extracted, so that the sulphuret of iron remains at the anode with the sulphur of the sulphuret of copper, and will be left as a residue on distilling to obtain pure sulphur. Ordinary chalcopyrites can be likewise treated.

If the ore, say, a sulphuret like galena or chalcosine, be used as the cathode, with an unattackable anode like conducting carbon, and with an electrolyte which will yield hydrogen at the cathode like water acidified by sulphuric acid, reduction of the ore by desulphurization takes place on the cathode with the formation of sulphuretted hydrogen, which will be partly collected for use and partly decomposed with the production of sulphur. When the ore contains several metals, they will

remain mixed on the cathode, and the mixture may be used as an anode as above described. Dechloruration of a chloruretted ore (chloride of silver), or deoxidation of an oxidized ore (protoxide of copper, protoxide of iron, &c.) may be effected by reduction like desulphurization.

Different ores may be used simultaneously as anode and cathode ; thus, iron pyrites may form the anode, and sulphuret of copper the cathode.

[*No Drawings.*]

A.D. 1882, April 21.—No. 1913.

CLARK, ALEXANDER MELVILLE.—(*A communication from Amedée Mathurin Gabriel Sébillot.*)—Obtaining metals from ores.

After being finely pulverized (and, in the case of sulphurets, calcined in retorts to remove excess of sulphur and reduce bisulphide of iron to monosulphide), the ores are acted on by concentrated sulphuric acid heated sufficiently to boil and distil it. Thus the ores are obtained as matts, containing the metals as sulphates to be separated by lixiviation, &c. A long furnace, heated like a muffle, forms a gallery of uniform section to contain a series of cast-iron trucks or pans mounted on wheels to run on rails, the pans fitting so closely within the muffle as only to admit enough air to convert sulphurous acid into sulphuric acid. The flames from a grate pass between the muffle and the arch of the furnace. The trucks, containing a mixture of ore and sulphuric acid, are gradually moved through the furnace, the end doors of which are opened at intervals to remove from the hotter end a truck when it has become "thoroughly dry," and introduce at the cooler end a truck with a fresh charge. Pipes, corresponding to the positions of the trucks in the muffle, lead therefrom, to a condenser for the excess of sulphuric acid, while the sulphurous acid passes on to a sulphuric-acid chamber, where it is reconstituted and loss is made up by burning sulphur or pyrites. The ore thus treated is lixiviated in tanks, and simple chemical operations, varying with the kind of ore, take place. The solutions will generally contain the sulphates of base metals, like zinc and iron, while silver, gold, and sulphate of lead will remain in the residue. If any copper is dissolved, it may be precipitated by iron so as to have it in the residue. On treating the latter again as purified

ore in the same way, all the silver and copper come into solution; and the gold free in the final residue is recovered by amalgamation.

On evaporating the solutions and then distilling off the sulphuric acid in large retorts, pure oxides of iron or zinc, or both, remain as large porous cakes, which harden and are fit for reduction to the metallic state by carbonic oxide. The cakes are charged into a round or rectangular shaft through a door at the top, according to a drawing, and the metal, continuously reduced at a low temperature, is withdrawn at the bottom. Carbonic oxide, generated in an adjacent furnace, passes through a flue around, and thence by openings into, the shaft. When the spongy metal produced contains both iron and zinc, it may be charged together with fuel (by means of a bell) into a cupola furnace with a closed top. This furnace has openings at a proper height for the zinc in a state of vapour to pass off with the gases, first to a cast-iron kettle heated enough to keep the zinc molten, and afterwards to a condensing chamber where the fumes are collected. The kettle is shown in a drawing as set in a small furnace and having a plugged hole for running off the molten zinc.

[*Drawings.*]

A.D. 1882, April 24.—No. 1935.

COOPER, William Samuel.—Portable melting furnace.

A furnace supplied with liquid fuel may be used for melting lead, tin, &c. The stand or lower part forms a reservoir for the liquid, which is raised to the burner by the expansive force of air forced into the reservoir by an air pump placed in the stand. Thus the liquid is forced up a pipe, through a controlling-valve, and thence to a retort where, by its own heat, it is converted into gas, and from thence passes to burners, which, with the retort, are supported on the top of the stand by studs or bolts. The burners may be left open or may be covered, holes being then provided to supply air for combustion. In either case the flame rises up an opening in the centre of the retort. A shield may be fixed above the burner to distribute the flame around the pot or vessel containing the metal to be melted. The pot rests on supports. A movable cowl is placed on the top of the retort and surrounds the pot during the time of melting. The

cowl has a side door for inserting irons &c., to be heated at the under side of the pot during the melting. Any number of burners may be used, according to the amount of metal to be melted, and sometimes the air pump, reservoir, and retort are made separate. A handle for carrying the furnace is hinged to the side by a connection containing a locking motion, to hold the handle rigid when in use and prevent the furnace from tipping over when there is metal in the melting-pot in its upper part. A pin, whereon the handle is hinged or swivels, has a head of the shape of a keystone ; and a slot of corresponding shape at one end is formed in the end of the handle, the other end of the slot being so recessed as to allow the head of the pin to turn in it. When the handle is beside the furnace, the pin is in contact with the large end of the slot, but when raised to carry the furnace, the pin engages with the narrow end of the slot of keystone or other shape, corresponding to that of the pin, which might be square or of other angular contour.

The fuel consumed is controlled by a valve, which may be held in its seat by a screw or cam. In one valve described, the spindle is fitted and packed in a screw, and opened as usual in steam valves. The lower end of the spindle is hollow, and has four or more holes of equal or different size, through which the fluid passes. The hollow part is accurately fitted into a tube, through which the fluid also passes, its flow being regulated by the number of the holes exposed. A shoulder on the spindle above the holes is forced down against a seat when the valve is closed. In another valve, according to a drawing, a pipe with inlet holes near its closed bottom slides up and down inside a fixed pipe, so as to determine the number of holes left uncovered. It is moved by a rack and pinion, actuated by a handle, a quadrant indicating the position of the valve. A taper circular plug valve, provided with rack and pinion, may be fitted in the bottom of the reservoir to draw off the liquid if desired.

A valve for lubricating machinery is also described, the extent of opening being here regulated by a circular inclined plane or crown cam.

[*Drawing.*]

A.D. 1882, April 24.—No. 1939.

DAVIES, David.—(*Provisional protection only.*)—Metal rollers used in coating plates with tin and other metals.

The rollers are made hollow, of uniform section throughout, and they are reduced at each end to form the bearings by swaging, rolling, spinning, or in dies under a steam hammer or hydraulic or other press. Or the ends may be made separate and welded on to the tube. Or the tube may be tapped at the end to receive screwed reducing thimbles. Or the rollers may be made with one piece of weldless steel, malleable or cast iron tubing, with hollow ends inserted to form the bearings. Or the rollers may be made with or without an end bearing cast thereon, and having the ends recessed on the inside to receive the bearing pin or pins, which may be made hollow.

[*No Drawings.*]

A.D. 1882, April 25.—No. 1954.

TAYLOR, Henry Francis.—Pickling and washing metals.

The bath containing the liquid is supported on a rocker or on trunnions. The articles to be treated are placed in a cradle, carried by rods from a frame suspended by chains, so that it may be raised and lowered by a piston. Arms on the frame slide in forked guides to keep the frame upright; and a link attached to an arm of the frame engages with a loop on the bath, so that as the frame is lowered and raised the bath is rocked. The piston is loaded with weights to counterbalance the weight of the frame and its attachments. The chains pass over pulleys on arms, which turn on friction rollers as the cradles are carried round from one bath to another. To circulate the liquid a division plate is placed in the bath, on each side of which the cradles are placed. A centrifugal or other pump causes the liquid to circulate through and between the articles to be treated. The pump may be placed outside the bath and arranged to draw the liquid out at one end of the bottom, and deliver it again through a pipe into the top at the other end of the bath.

[*Drawings.*]

A.D. 1882, April 28.—No. 2011.

JOHNSTON, David.—Diminishing the liability to corrosion of screw-propeller blades.

The outer part of the back of each blade is coated with tin or other metal or alloy, the surface to be coated being first

cleaned by grinding with an emery-wheel and then heated sufficiently to allow the coating-metal to adhere.

[*Drawings.*]

A.D. 1882, May 2.—No. 2070.

HADDAN, HERBERT JOHN.—(*A communication from Louis de Soulages.*)—Dressing ores &c.

After breaking by the hammer into pieces not exceeding 0·25 metre and separating the barren stone, the ore may be reduced preferably by Blake's stone-breaker to pieces 0·025 metre in diameter or smaller. Then a compressing mill, comprising a distributing cylinder and two horizontal rollers, which terminate in slightly cone-shaped cast-iron hubs and have steel jackets, may be used to reduce the material to granules from 1 to 3 millimetres in diameter; or a rammer mill, say, Vapard's pulverizer, may be employed (according to the character of the ore).

Drying is now to be effected at a temperature of about 200° Cent., and the evaporation of the water destroys adhesion and forces the small granules to divide into waste material and ore, which are afterwards easily classified. The granules are dried in slowly passing through a conical metal cylinder, revolving on a horizontal axis, and containing curved blades and a helical channel, say 125 metres long. The cylinder is boxed in with a casing, and is heated by gas, which enters the box at the lower part and escapes, after combustion, through a flue at the upper part.

To classify for bulk, the dried stuff enters the innermost barrel of a machine comprising 3 concentric, conical, perforated sheet-metal barrels or cylinders. This barrel rejects stuff exceeding 0·003 metre thick to be returned to the crushing mill. The second and third barrels in turn separate stuff coarser than 0·002 and 0·001 metre, respectively, from that which is still smaller, different receptacles being provided for the separated lots. The barrels have brushes to keep the perforations free from obstruction.

Classifying for density is accomplished by a machine, termed a ventilo-separator, and made of three patterns. The first kind or direct ventilo-separator consists of a long metal chamber, closed in at the end where the wind escapes. At its front end

a fan sucks in the air through six openings and forces into the chamber the siftings, which are dropped by a distributing cylinder in front of the blast outlet. Owing to gravitation and wind pressure combined, the stuff settles down in the chamber in order of density, the densest parts nearest the blast. The second kind, or sucking ventilo-separator differs by taking the air from a reservoir to secure a more regular blast. The third kind, or centrifugal ventilo-separator, comprises two sheet-metal circular trays, resting upon a light iron frame, and inclined one towards the other. The two trays are connected together by screw pins, the intervening space being thereby adjustable. The upper tray extends upward funnel-fashion (where the air is drawn in), and is surmounted by a distributing cylinder. The lower tray is attached to an upright revolving shaft. A circular channel surrounds the outlet of the lower tray, and leads the product down through inclined shoots. As the machine works, a vacuum will be produced in the middle of the two trays, and the stuff, dropping into the funnel, is powerfully drawn in between the trays and driven beyond them under centrifugal force: the densest portions will be held back and drop into the circular gutter, while the lighter will be shot outwards into the chamber of the machine. A drawing indicates the circular outlet for the heaviest stuff as an annular opening in the lower tray about midway between its centre and periphery.

The operations proceed automatically, closed inclined tubes connecting the different apparatus. According to an example given, hydrated brown iron ore may be freed from moisture and combined water and from nearly all worthless matter. Auriferous sands &c., seldom require drying, and sands need not be crushed.

[*Drawing.*]

A.D. 1882, May 2.—No. 2071.

HADDAN, Herbert John.—(*A communication from Louis de Soulages.*—Smelting-furnaces.

Ores, previously pulverized, and enriched in accordance with another Specification, No. 2070, A.D. 1882, may be smelted directly on the hearth in a furnace, comparable to a reverberating and a blast furnace, by the agency of carbonic oxide gas, which is burnt either by the metalloid itself or by the

oxide of the ore at such a temperature as the particular ore treated may demand. The furnace is constructed of strong metal plates with binding rods, forming a closed frame or box, and prolonged into a chimney at one end ; at the other end, there are tuyères with regulating taps for supplying air and gas. The frame is lined with firebricks while the hearth is faced with a mixture of fireclay, sand, and grit or graphite, amalgamated with a little asbestos, well rammed down. A drawing shows a furnace with a depression in its bed, and at one end an upright shaft, at the top of which is a distributing colander to supply a continuous and regulated downpour of powdered ore. A slope leads from the bottom of the shaft to the depression. An outlet pipe conveys the gases of combustion from below the colander to beneath the bell of an hydraulic valve. The bell has two compartments, and communicates with a chimney. A partition separates the compartments, and, by raising or lowering the bell, the size of passage and speed of escape of the gases may be varied and the strain inside the furnace may be adjusted. There are a small gas-holder, acting as a regulator, and a ventilator. The furnace having been highly heated by burning carbonic oxide gas therein (during which operation the gases of combustion may be carried off by a branch of the chimney), the melting of the metal contained in the ore is effected by converting carbonic oxide into carbonic acid by the absorption of the oxygen of the powdered ore, which descends slowly through the ascending gas and becomes highly heated in the shaft. During this operation air is excluded, and the carbonic acid produced passes by the other branch of the chimney to apparatus for reconverting it into carbonic oxide for further use. A melting-pan, set in masonry beside the furnace, and highly heated by a burning blast of gas and air, receives the molten metal direct from the hearth. The pan has an arched roof, fire flue, chimney, and tapping pipe.

Apparatus for producing and storing carbonic oxide comprises a furnace with retorts, some for the reduction of carbonates (until the smelting furnace gives off carbonic acid), and others for converting carbonic acid generated in the smelting furnace into carbonic oxide. The retorts have upper compartments containing enough glowing coal for the said conversion, while lower compartments in some of them contain a mixture of carbonates and coal to produce carbonic

acid. A large tank, fitted with hydraulic valves, receives the gases and steam from the retorts. An extractor draws the gas off from the tank into a compensation gas-holder, whence the gas is driven into the smelting-furnace.

[*Drawing.*]

A.D. 1882, May 3.—No. 2082.

LISHMAN, THOMAS.—Metallurgical furnaces.

Methods of heating double and single furnaces for puddling, heating, &c., are described. The furnaces preferably have an iron casing or shell outside the brickwork &c., and a lining of ground anthracite, blacklead, ground burnt fire-brick, common brick, or clay, lime, manganese, silicate of alumina, hæmatite, and ground forge cinder or scale, mixed or made into bricks or stiff paste and put in as usual. The "rubble hole" in the charging-door may have an opening or flue, communicating at its top with a funnel or leading to the chimney, in order to convey away cold air entering the furnace at the hole and prevent its affecting the molten metal. The fuel is received preferably in a sort of basket with open sides and ends, or an arrangement of grates may be used and be encased by doors. Combustion is effected by a supply of hot air and steam conveyed to the gas chamber, also under the grates, and to receivers at the sides and back end of the chamber; the gases meeting therein and the hot air are conveyed to the furnace by orifices. The unconsumed gases and air, after passing over the floor of the furnace, may be returned through a flue for use again, the surplus gases being otherwise disposed of. Steam jets are applied beneath the floor of the furnace and grate bars above the ash-pit. Steam and hot air are passed through the hollow bridges and through orifices to the furnace, intermixing with the gases escaping from the "accumulator" and fire-chamber to perfect the combustion and increase the heat, valves or doors regulating the action. The supply of fuel is preferably placed in a hopper, at the bottom of which is a fluted shaft turned by a wheel, to crush the fuel to a regular size and better distribute it. To heat the air fed to the furnace and preserve the materials thereof, channels may be formed along its bottom, or pipes may form its bottom, and be traversed by the air. At the centre of the

hollow fire-bridge there may be a hollow pillar, extending to and supporting the roof of the furnace. The pillar has orifices for emitting the steam and air admitted. Channels or flues, chambers and orifices, may be variously arranged for conveying the air, steam, and gases. The grate bars may be hollow and communicate with the bridge, which is divided into compartments, and above which are special bricks provided with orifices partly vertical and then extending horizontally to the front of the bridge. A fan may be used to supply air, or a jet of steam may increase the current of air. A wormed shaft may be attached to the end of the furnace and gear with pinion-wheels secured to the ends of the firebars, which may thus be rotated; or a ratchet motion may be employed. A furnace may have a double firegrate with a partition wall between the fire-chambers and extending to the bridge. This furnace may be worked from either or both sides or from the front end by means of suitable doors. The covering of a hot-air channel at the top of the furnace is preferably made of light cast-iron plates covered with sand or the like. The arrangement of firegrate may be modified, or the bottom of the grate may be formed of perforated plates or of bars placed close together. The sides of the grate may consist of iron bars or of perforated cast-iron or bricks.

[*Drawings.*]

A.D. 1882, May 4.—No. 2106.

TAYLOR, Henry Francis, and LEYSHON, George.—"Coating metal plates with tin, lead, and other metals or "alloys."

The plates are fluxed, coated, and finished in one pot and in one operation by the following means:

A vertical coating pot with converging sides is furnished with an entrance flux box containing (preferably) fixed guides, and an exit finishing grease box containing pressing rollers. As soon as the plate passes through the guides of the flux box and dips beneath the molten metal in the coating pot, it is gripped by nippers which are raised by handles from the bottom of the pot up an inclined guide; the workman then slides the nippers down to the bottom of the pot, cants or turns them, and raises them again, thus bringing the top edge of the

plate within the grip of the finishing rollers on the opposite side of the box.

[*Drawings.*]

A.D. 1882, May 23.—No. 2430.

RAYNES, JAMES TREVELYAN, and HEALEY, BRIERLEY DENHAM.—Calcining-kilns heated by gas.

Reference is made to the prior Specifications No. 85, A.D. 1872 (which partly relates to gas generators), No. 2278, A.D. 1880, and No. 1865, A.D. 1881.

According to the present invention, gaseous fuel passes continually into the ores or other materials under treatment and, meeting with air which has become heated in rising through the calcined ore below, is burnt, and the flame, rising through the descending ore above, dries, heats, and calcines it. The ore, in descending towards the combustion chambers, is divided into streams by Λ-topped deflectors upon arches or walls, the flame ascending in nearly vertical currents through the ore, which descends in oblique streams upon inclined surfaces over each of the two or four ranges of gas inlets. The air is admitted partly by inlets at about the level of the drawing-out doors and partly through these doors. The heat of the gaseous fuel is kept high by erecting the generators close to the kiln, or by checking radiation when they are built at a distance. Valves regulate the supply of gas and air to the kiln. No dampers are required to change the currents in these continuous regenerative kilns ; and, as two currents at least of burning gas are always rising through the ore, more work can be done than in the cases of the secondly and thirdly-mentioned prior Specifications. The gas and air may be partly admitted through flues and inlets, shown in a drawing as built in a wall supporting a central deflector. There are also side flues and inlets for the gas. Flat bars, introduced at the drawing-out doors, keep the calcined material from running out when not required. The apex of each deflector is coped with vitrified fireclay blocks, which have tie bars passing through them and into the walls of the kiln.

The kilns may also be constructed with an arched top and two side shafts communicating with the kiln by inlets near its

top, according to a drawing. In this case the charging openings have doors, which are not wanted when the top is open.

The gas generators may be constructed more durably and cheaply with supporting arches and incline arches in place of heavy castings for the fuel inclines; and the charging-boxes are plain boxes with movable covers instead of boxes containing flap valves.

[*Drawings.*]

A.D. 1882, May 25.—No. 2484.

DICK, George Alexander.—Alloys.

(1.) Alloys of copper, zinc, and iron, with or without tin, may be obtained by previously alloying the iron in definite and known proportion with the zinc which when molten absorbs or dissolves up to about 5 p. c. of wrought iron. As the proportion dissolved varies with the temperature, a gas or other furnace capable of working at a uniform temperature should be used for heating the crucibles employed, which should be kept as much heated as possible without volatilizing the zinc. Thus the required definite alloy of zinc and iron may be uniformly produced; and by adding it to the copper, or copper and tin, there may be introduced any quantity of iron up to about 5 p. c. of the zinc contained in the improved alloys.

(2.) Manganese-copper may be employed to deoxidize the oxides contained in alloys of copper and iron, with or without zinc or tin or both. From 1 to 20 (or from 2 to 50) p. c. of manganese-copper, containing from 2 to 50 p. c. of manganese and from 98 to 50 of copper, may be added to—

(*a.*) Alloys containing from 0·1 to about 5 p. c. of iron and from 99·9 to 95 of copper.

(*b.*) Alloys containing from 0·1 to 5 p. c. of iron, from 50 to 65 of copper, and from 49·9 to 30 of zinc, the manganese-copper being sometimes added to a zinc-and-iron alloy prepared as above described, or to the refuse from galvanizing works (hard spelter) which is analysed to determine the amount of iron present.

(*c.*) Alloys containing from 0·1 to 5 p. c. of iron, from 0·1 to 10 of tin and from 99·8 to 85 of copper.

(*d.*) Alloys containing from 0·1 to 5 p. c. of iron, from 0·1 to 10 of tin, from 1·8 to 45 of zinc, and from 98 to 40 of copper.

The amount of copper present in the manganese-copper is to be reckoned as forming part of the finished alloy; and sometimes the manganese-copper may be added to any of the ingredients before or during the manufacture of the alloy.

(3.) There may be added to the last-mentioned alloys, or to any of their ingredients before, during, or after their mixing, a proportion of manganese-copper in excess of the amount required to effect deoxidation, so that a definite quantity of manganese (say, from 0·1 to 10 p. c.) will remain in the finished alloy.

(4.) From about 1 to 10 p. c. of lead may be added to, or in the course of producing, the last-mentioned alloys containing manganese.

[*No Drawings.*]

A.D. 1882.—No. 2484.*

Disclaimer and Memorandum of Alteration to the Specification of the preceding invention, filed December 4, A.D. 1889, by George Alexander Dick.

[*No Drawings.*]

A.D. 1882, May 30.—No. 2550.

SHEARER, MAURICE, senior, and SHEARER, MAURICE, junior.—Sifting.

The material for treatment is fed through a hopper into the upper end of a sifting cylinder, fixed eccentrically on a shaft, which revolves in bearings fitted at different heights. Thus the slanting cylinder rotates with a compound oscillating and eccentric action, and the finer portion of the material passes through the perforations or meshes in the cylinder, while the coarser is discharged at the lower end or retained in the cylinder if desired.

[*Drawing.*]

A.D. 1882, June 8.—No. 2682.

AITKEN, HENRY.—Treating carbonaceous, bituminous, calcareous, and other substances.

The inventor refers to his prior Specifications No. 352,

A.D. 1868 (which relates to treating ironstones and ores and to draw kilns), and No. 57, A.D. 1874 (which relates to coking coal &c.).

Metalliferous ores are among the substances which may be treated in accordance with the present invention, carbonic oxide or carbonic acid gas, sulphur, arsenic, lead, zinc, mercury, and other metals being obtainable, as well as ammonia. Blast-furnace gases and those resulting from the coking of bituminous iron ores and from the calcining or roasting of ores and the products of combustion from furnaces generally may be washed with, or passed through or over, hot or cold tar, pitch, oil, bitumen, grease, or fat (preferably of high boiling point), in order to absorb dust, soot, or other solid suspended substances, including metals, and to so produce an asphalt-like substance which may be placed in a still and fracturinated to separate the different contents. If the dust contains metals or ores worth recovering, the inventor distils and burns off the tar, pitch, or bituminous matter, and so recovers them or smelts the blocks so obtained. To absorb the dust &c. the gases may be passed into an apparatus, which comprises a casing (a horizontal cylindrical casing, according to a drawing) with a central revolving shaft, carrying discs and a wire gauze or perforated cylinder. The casing, which is charged with the tar &c. to any required depth, contains rings, corresponding in position to the discs and with an opening in each alternate ring at the upper part at alternate sides, so that the entering gases pass through the perforated cylinder, which becomes coated with the tar &c., and causes the same to pick up or absorb the dust or other finely-divided substance carried in the gas. Steam may be passed through pipes (shown as contained within the lower part of the casing), and heats and liquefies the absorbed material, when solid, or a viscous substance used as the absorbent. There are inlet and outlet pipes for the tar &c. When required, the tar may be cooled by passing cold liquid through pipes contained in a condenser. Sulphur and hydrocarbon compounds are among the substances to be separated. The pollution of the atmosphere by soot and sulphur is prevented.

On the top of a blast furnace may be erected a series of chambers, preferably upright and wider at the bottom than the top. Ore, coal, &c., may be charged into the (preferably different) chambers, and the gases from the blast furnace are

passed through the chambers to drive out volatile matters from the contents, whereupon doors at the bottom are opened, and the materials drop down to be charged into the furnace. The gases, which may be passed through hot carbon for conversion into CO, or which may be heated in a heater, may be led by pipes from the blast furnace to the top (or sometimes to the bottom) of the chambers (where water or superheated steam is added); and, after traversing the chambers, the gases may be conveyed to condensers. The doors of the chambers are faced truly; and water, tar, or sand is used to make a tight joint, to and from which pipes convey the water or tar. The top doors may be of firebrick with a luted door above: the bottom doors are of iron and may be moved by hydraulic or other power. Again, the chambers may be placed on the ground separate from the furnace, the gas being brought down in protected pipes. Or the top portion of the blast furnace may contain compartments or chambers without bottom, water or steam being introduced into the furnace. Raw ores containing CO_2 and sulphur can be used at once, the steam and gases carrying off these constituents, and blackband and carbonaceous ironstones may be also treated.

Steam or water may be admitted into calcining kilns with the object of obtaining ammonia and sulphur: ironstone may be calcined in chambers, towers, or draw kilns, provided with bells or doors, the fumes being drawn off and condensed. Blast-furnace or other gases may be used, instead of coal, for heating these kilns.

[*Drawings.*]

A.D. 1882, June 9.—No. 2703.

STUART, JOHN MEDLEY, and ELLIOTT, JOHN.—Treating ores.

The object is to render the ore friable and free it from sulphur, so as to fit it for leaching, amalgamation, or other process of separating gold, silver, copper, or other metals: amalgamation is preferred, some solid acid, preferably acetic said, being added to keep the quicksilver in a better state for union with the gold &c.

The ore, preferably of about the size of a hen's egg, may be

placed in an upright square furnace or receiver. Flues are carried up in each internal angle and have apertures communicating with the space containing the ore ; or pipes may be carried up the angles or up the centre of the furnace. In packing the ore in the furnace, it should be sprinkled at intervals with potash or saltpetre, or both ; and at greater intervals a layer of sawdust should be introduced. Ovens or fireplaces or apparatus for using petroleum fuel, at the bottom of the furnace, generate heat, which is conducted to the said flues to be disseminated through the ore and heat it to redness. Then earthen vessels containing water may be placed in the ovens to generate steam to act on the ore, which is subsequently permeated and acted on by a gas prepared in the following way:—Materials, which preferably comprise about 1 part of sulphate of copper, 1 of potassium, and 8 of salt, with a little scrap iron, and also water in proportion to the strength required, are heated in retorts communicating with the said flues. The gas thus generated is forced thereby through the ore, such forcing, if needful, being aided by a blast, produced mechanically, or created or aided by placing in the retorts hanks of asbestos or cotton thread or both, portions thereof being laid through heated pipes communicating with the furnace. The retorts may have necks long enough to admit of separate application of heat to them, if the asbestos and cotton tanks are used to force in the gas, the claims including the heating of the neck of the retort for the purpose of forming a blast. The bottom of the furnace inclines to one side, where there is a discharging door. The furnace and flues have covers to be opened as required ; and dampers shut off the retorts and ovens successively. The ore for treatment may be stacked on a platform round the top of the furnace, which may have a hood and cowl to conduct fumes away from the men there.

The process above described, with the addition of proper fluxes to the ores, may often be applied to reduce them to a metallic state.

[*Drawing.*]

A.D. 1882, June 9.—No. 2715.

PARNELL, Edward Andrew.—Extracting metals from regulus or matte.

Regulus or matte, obtained by smelting argentiferous or auriferous pyrites, and consisting chiefly of protosulphide of iron with precious metals and generally some sulphide of copper, may be treated with hydrochloric acid, a slight excess of which will, by converting the sulphide of iron into ferrous chloride, almost entirely eliminate the iron from the insoluble sulphides: sulphuretted hydrogen is evolved, and the acid liquor obtained may be rendered neutral by contact with fresh regulus. As long as sulphuretted hydrogen is present, all the copper remains undissolved, as sulphide, together with the silver and gold. Any lead, which may dissolve, can be precipitated by metallic zinc or by a solution of sulphide of sodium. If the regulus contains five per cent. or more of copper, moderate heating will assist the action of the acid. A stone or wooden tank may be used with a perforated false bottom to receive a layer 3 or 4 feet thick of easily decomposed regulus in pieces of about the size of a walnut. Much finely-divided insoluble sulphide is carried through by the liquor and will settle in an adjacent tank. Grinding the regulus and its agitation with acid (conveniently in a horizontal revolving cylinder) is useful when the action is sluggish owing to the copper present. The insoluble sulphides (usually of copper and lead with precious metals) may be treated to separate the various metals by known means or as described below.

The same regulus, or regulus in which copper predominates, when finely powdered may be treated with a solution of ferric chloride preferably aided by heat, as by a steam jet. Sulphides of iron, copper, and lead are decomposed and converted into chlorides, sulphur is set free, and the ferric is reduced to ferrous chloride. A residue is left consisting of the precious metals (part of the silver being as chloride), siliceous matter in the regulus, and possibly chloride of lead and a little undecomposed regulus, together with free sulphur: after drying and gently heating to sublime or burn the sulphur, the precious metals are extracted and refined by known means. From the solution the copper may be precipitated as metal by iron, or as sulphide by sulphuretted hydrogen. The liquor will form a source of ferric chloride for further use: enough hydrochloric acid is added to correspond to one-half the ferrous chloride present, and the liquor is exposed to the air till oxidation to ferric chloride takes place. The treatment of the regulus may be commenced with

solution of cupric chloride, which acts in an analogous way to ferric chloride. The copper dissolved likewise plays an important part. Cupreous chloride is converted into cupric chloride in the presence of hydrochloric acid and air : thus a mixture of cupric and ferric chlorides will become the solvent. Again, ferric sulphate may replace ferric chloride : in this case the mixture with regulus is preferably evaporated to dryness in a pan with surface heat, and moderately heated with exposure to air to oxidize the ferrous sulphate formed ; and the ferric sulphate reacts on more regulus.

The regulus may be first partly calcined and then treated with hydrochloric acid, the ferric and cupric chlorides thus produced reacting on the remaining sulphides. Or the calcination may be complete, and the said chlorides be used for acting on raw regulus.

A solution of ferric or cupric chloride or ferric sulphate may be used to separate copper from the argentiferous residue undissolved by hydrochloric (or sulphuric) acid. The light fine portion is easily acted on : the gritty part should be first reduced to fine powder. The regulus may be first decomposed by hydrochloric acid ; and then the ferrous chloride liquor obtained, holding the undissolved sulphides in suspension, may be exposed to the air in presence of hydrochloric acid, when the other action above described takes place.

From the ferrous chloride liquor, hydrochloric acid may be recovered by evaporation and furnace treatment with the aid of steam, or ferric chloride with access of air. The ferric chloride volatilizes and may be condensed for the most part in a solid state.

The inventor is aware that sulphide ores, both raw and roasted, have been somewhat similarly treated.

[*No Drawings.*]

A.D. 1882, June 13.—No. 2767.

JUSTICE, Philip Middleton.—(*A communication from Melvin Batchlor Church.*)—Grinding-mills.

Ores may be treated. Grinding takes place between upper and lower stones. The lower and revolving stone has from eye to skirt a perfectly plane level surface, which may be either quite smooth, or formed with a very fine shallow crocking for helping

the stones to stick to the goods or material under treatment and whirl them about and prevent them packing down on the stones. The upper stone is formed very slightly and uniformly dishing from eye to skirt, and its surface also may be crocked. A slight pocket immediately about the eye will admit the material, which has to crush or grind itself mainly against its own substance, and wholly to a uniform fineness. The two stones are kept slightly separated, and all the parts of the space between them must be kept filled and crowded with the goods, otherwise the action will be imperfect. The dish of the upper stone is therefore so proportioned that, as the goods move outward, they will have the same space (decrease in depth in proportion to the increase in length with allowance for increased bulk by reduction) in zones of a given width at every point from centre to skirt. The goods are carried outward by centrifugal action alone. The feed of the goods and speed and adjustment of the stones are regulated to obtain the fineness and uniformity of product required, ordinary driving and adjusting mechanisms being applicable. A feed regulator, referred to in connection with the regrinding of plaster and like materials, comprises a supply chamber, wherein is a feeding-screw partly enclosed by a closely-fitting casing, through which the screw uniformly carries the material to a pipe leading to the stones. The screw is actuated by cone pulleys and a connecting band, so that the feed may be regulated to keep the said space full without clogging at the eye; and more particularly an automatic regulation can be effected, to correspond with variations in the speed of the stone as it works, by connecting the cone pulleys to any convenient part of the mechanism which drives the stone.

[*Drawing.*]

A.D. 1882, June 14.—No. 2791.

LIPPS, JOHANN PHILIPP.—(*Provisional protection only.*)—Sieves.

To vary the size of the slits or perforations, the drum of the sieve may consist of two sheet-metal cylinders, so fitted one inside the other that, while being in close reciprocal contact, they may be shifted in respect to each other longitudinally. The cylinders have like holes, forming by preference transverse

slits, and registering together. When the movable, say, the outer, cylinder is so adjusted relatively to the other that the holes of both correspond, the entire width of the holes will be free for materials to pass through, whereas when their relative positions are altered, the bars or solid parts of one cylinder will more or less cover the holes of the other, thus reducing the free width of the holes.

The different appliances used for this adjustment may allow it to be made either whether the sieve is operating or not, or only while it is at rest. Thus, a sleeve may be placed on the shaft of the sieve and be fitted into a plummer block, in which it may be turned by hand, while it is forced to screw itself forward or backward by means of a fixed pin or stud projecting into a helical or oblique slit in the sleeve. This sleeve is coupled to the movable cylinder so as not to interfere with the rotation of the sieve ; but so that the longitudinal movement of the sleeve, on its being turned, will produce a like displacement of the movable cylinder relatively to the one fixed on the shaft.

[*No Drawings.*]

A.D. 1882, June 15.—No. 2826.

CHEESBROUGH, Frederick John. — (*A communication from Asabel Knowlton Eaton.*)—Manufacture of lead as thread-like fibre.

A charge of molten lead is placed in a retaining strong steel or iron cylinder, to the bottom of which is firmly secured a finely-grooved die plate ; or the bottom and also the lower part of the sides of the cylinder may be finely perforated. The ram of a hydraulic cylinder above forms a piston accurately fitting the first-mentioned cylinder, columns and a bed-plate being used for supporting the apparatus. The first-mentioned cylinder and its piston are kept hot, and by applying pressure to the latter the lead is preferably forced out through the grooves, perforations, or creases, while in a semi-molten state, into the cold atmosphere ; and, being divided into very fine threads or fibres, cools as it issues from the cylinder.

The invention may be used in making white lead, packing for stuffing-boxes of engines, &c.

[*Drawing.*]

A.D. 1882, June 19.—No. 2900.

CLARK, Alexander Melville.—(*A communication from Thomas Brennan, William Garnett Munn, William John Duncan, William Augustus Meriwether, and Charles G. Davison.*)—Furnaces.

To secure more perfect combustion in furnaces, air is excluded and an artificial draught is produced by using pipes with openings, which pass steam in straight or diagonal lines across and above the fire ; and some petroleum or other cheap oil is fed into the steam-supply pipe by adjustable self-oilers. In "circular "furnaces for melting metals," the steam pipe passes around the combustion chamber and steam is supplied above the fuel by radial jet pipes, the arrangements being variable according to the construction of the furnace. The oil and steam enter the furnace together and, becoming vaporized or decomposed, unite and form a highly combustible compound, which burns fiercely and consumes all the fuel, thus preventing waste and making a hotter fire than by the ordinary method of steam and air draughts. Also the steam strengthens the draught greatly, the need of high chimneys being obviated ; the oil keeps the pipes and jets clean and free from rust.

[*Drawing.*]

A.D. 1882, June 24.—No. 2996.

BRUCE, Stuart.—(*Provisional protection only.*)—Sifting &c.

Ground ores may be treated. A preferably oblong holder or case, having a feed opening at one end, and so enclosed as to check any escape of the finely-divided substances operated on (except at the proper outlets), contains one or more inclined "bolting" cloths or fine sieves, which, when arranged in tiers, preferably increase in fineness towards the bottom of the series. Brushes can be used to prevent the cloths from becoming clogged. The holder is guided by fixed guides, attached to the main frame of the machine, and is so disposed that it may receive at both ends a reciprocating or jigging, vertical or nearly vertical, motion, which is derived from cranks, eccentrics, levers, or other appliance and connecting-rods worked from a driving shaft. The weight of the holder and cloths may be counterbalanced as by springs. The finely-divided substance for treatment enters from a hopper with adjustable feed, and, as it

moves on, the upward jigging motion ensures the passage through the sieves of the heavier and finer portions of the substance: while the lighter and larger portions pass along the inclined surfaces into separate compartments for collecting the different qualities of the material.

[*No Drawings.*]

A.D. 1882, June 28.—No. 3046.

BARKER, RICHARD.—Extracting gold and silver from their ores by electricity and mercury combined.

A preferably wooden inclined table is formed with riffles or baths containing mercury; and the quartz, alluvial deposit, or other matter for treatment is carried down over the table by a current of water and passes through the different riffles. The negative pole or cathode of a battery or other source of electricity is connected to the mercury in the riffles, the electric current being conveyed by wires from riffle to riffle; and the positive pole or anode is introduced into the water immediately above the mercury and sufficiently close to it to cause an energetic action and agitation at the surface of the mercury, which is kept bright, and is prevented from "sickening" in the presence of arsenic, sulphur, oil, &c., while titanic sand or other heavy mineral is prevented from forming an obstructing layer on its surface. Thus the mercury will readily amalgamate with the particles of gold and silver, contact being ensured. The electric current passes through the water, a stratum of which constantly covers the mercury; and the anode must not come into contact with the mercury. The conducting plates, wires, &c., placed in the water, may be either stationary or movable.

Apparatus for treating refractory ore may comprise ten or more riffles in four series. The riffles of the first series are provided with revolving stirrers and electrodes (anodes). Arms or pins, acting as stirrers, are attached to a shaft which also carries shorter arms or pins, acting as electrodes, and insufficiently long to touch the mercury. A second series has like stirrers; but the current is conveyed by wires or plates laid across the riffle. The third series is without stirrers, but the current is supplied along a shaft as in the first series, while it is rendered intermittent by a special revolving electrode, the current passing when the arms or pins are perpendicular and being interrupted

when they are horizontal. Electric connection may be established by metal strips or bands on the surface of the wooden shafts, or by a metal core in contact with the inner ends of the electrodes ; which may be of brass or other hard and durable metal, the stirrers being of non-conducting material. The fourth series has no shafts or stirrers, and the electrodes (interlaced or not) are carried across the riffles. The mercury may be drawn off from the riffles by taps or cocks. The shafts are revolved (preferably 45 times a minute) by pulleys, driven by gearing. Other materials may be used for parts of the apparatus.

Lead and copper cannot be advantageously absorbed or separated.

[*Drawing.*]

A.D. 1882, June 28.—No. 3056.

HAMPTON, Thomas.—Removing ingots from moulds.

The mould is fitted with rings or eyes into which hooks engage. These hooks are pivoted upon levers which are jointed together at their lowest point, and carry at this point a rod, fitted with a pusher or plunger resting upon the top of the ingot within the mould. The outer ends of the levers are secured to short chains connected to a lifting hook, the arrangement being such that when the lifting chain is raised the plunger is pressed down and the ingot pushed from the mould.

[*Drawing.*]

A.D. 1882, June 30.—No. 3102.

LOVERING, John, and MARTIN, Robert.—Washing china clay.

An apparatus for trapping mica in washing china clay. The mica traps are raised by the action of a system of levers and connecting links, preferably actuated by a falling stream of water.

[*Drawing.*]

A.D. 1882, July 1.—No. 3122.

CLARK, Alexander Melville. — (*A communication from Charles Haegele.*)—Coating or plating metal surfaces with other metals or alloys.

Relates to the coating of metal plates, wire, fancy articles, &c. by welding at a red heat with special alloys, and to means for coating with precious metals.

For coating plates a sheet of the alloy is fitted upon the plate so as to exclude all air as far as possible. The overlapping edges of the alloy are bent down around the edges of the plate, and brushed with glue and whitening so that they will not become welded. The whole is then brought to a red heat and united by pressure or rolling. For rods or wires the alloy may be in the form of a tube, and for fancy articles the pattern is covered with the red hot alloy, and the pressure applied in moulds. For coating with precious metals, a paste of chloride of silver, tartar, and chloride of soda is applied to the surface, so as to give a layer of silver on which the precious metal can be applied. Alloys incapable of being rolled when red hot or containing large quantities of volatile metals can be applied by the use of an intermediate sheet of copper or suitable alloy, which will absorb the volatile metal and form an alloy capable of being rolled. Other alloys may be rolled cold to the required thickness and applied by pressure when red hot. No fluxes are used.

The following alloys are referred to (1) Copper-zinc, containing 82 to 95 p. c. of copper and 18 to 5 p. c. of zinc. (2) Containing copper 75 to 85 p. c., zinc 15 to 5 p. c., and nickel 20 to 5 p. c. Small quantities of tin and phosphorus may be added. Copper containing about 12 p. c. of tin or 15 p. c. of aluminium may also be used. German silver and brass may be used with intermediate sheets of copper.

[*No Drawings.*]

A.D. 1882, July 4.—No. 3162.

WIRTH, Frank.—(*A communication from Heinrich Hochstrate.*) —Dressing ores.

A revolving screen delivers into a series of hoppers, corresponding to the length of the screen, each hopper having one winnowing and dressing apparatus beneath it. Thus the crushed ore will pass into the lower part of an upwardly inclined channel or spout, wherein it meets a continuous or intermittent upward current of air from a fan or other apparatus whereby the light dusty particles are carried off to a chamber

divided into compartments of progressively increasing size, where all the dust is deposited. The heavier and granular particles of ore fall from the air current on to the lower surface of the channel and roll down it to the bottom, their descent being facilitated by deflecting plates fixed above the said lower surface to weaken the air current there, so that even the smallest particles may fall regularly. An adjustable vertical plate at the upper end of the channel deflects the current vertically, so that the thin splints and flakes, moving in the direction of the current, may be caused to fall on to the lower side of the channel. The heavier particles pass under a deflecting plate at the lower end of the channel into a rotating feeder, which discharges the granulated ore regularly into still water in a hopper leading into a vertical spout or channel, wherein water ascends. The ore sinks until it meets this ascending stream of water, the velocity of which is so regulated by adjusting an overflow gutter and an inlet valve that the specifically lighter particles are carried off by the stream, which overflows into the well of an elevating apparatus to be returned to the supply reservoir ; while the specifically heavier particles sink through the stream into a hopper-shaped bottom common to two adjacent spouts, whence another elevator removes them.

[*Drawing.*]

A.D. 1882, July 8.—No. 3250.

BURCH, Joseph, and ALLEN, Russell. — Refractory material.

A plastic mass, to serve as a coating or lining for parts of furnaces, may be composed of bauxite rendered coherent by a small addition of silicate of soda, or clay, and about 6 p. c. of graphite. This makes it infusible, and it will become intensely hard under strong heat ; capacity for resisting continuous attrition of flowing molten iron is also indicated.

[*Drawings.*]

A.D. 1882, July 8.—No. 3253.

PARRY, Robert.—(*Provisional protection only.*)—Smelting ores of iron and other metals.

The ore, fuel, and flux, reduced to fine powder, are injected

by a blast of air into a bath of metal already molten, preferably in a vessel like a Bessemer converter. Reduction would be instantaneous, when subjected to the heat of the molten metal: thus the whole smelting would take place below the surface of the metal, the gaseous products passing off.

[*No Drawings.*]

A.D. 1882, July 13.—No. 3333.

CLARK, Alexander Melville.—(*A communication from Charles Edwards.*)—Purifying metals.

Metals may be annealed or heated in a current of hydrogen gas, purified by washings, in order to extract all the metalloids prejudicial to the good quality of the metal. The mode of treating iron or steel is described. The pieces of metal are placed in varnished or enamelled and hermetically closed heated retorts, which have inlet and outlet tubes for the passage of the hydrogen. The outlet tube is plunged into a liquid reagent, for instance, a copper liquor, which prevents the entrance of air, indicates the extent of extraction of the impurities, and allows the gas pressure to be regulated. The hydrogen carries off with it aqueous vapour which comes into contact with the iron, and the heat destroys the combinations of iron with the metalloids, which are extracted as gases in combination with hydrogen. The excess of hydrogen prevents oxidation of the iron. The hydrogen also acts upon the carbon of the iron, disengaging part and diffusing the rest of it through the metal.

[*No Drawings.*]

A.D. 1882, July 14.—No. 3352.

BENNETT, James Moss.—Furnaces.

A furnace is charged with the materials for treatment like a blast furnace with a closed top, but has the form of a conic frustrum with the larger diameter at the bottom. Vertical rows of tuyères extend from the top to nearly the bottom of the furnace, each tuyère having a shut-off valve or cock, so that hot blast can be admitted to or turned off from any part of the column of materials in the furnace. The gaseous products are

discharged at the base of the furnace through one or more openings or passages, fitted with water-bridges and leading into reverberatory chambers, whence flues may conduct to a chimney, condensers, or other apparatus. Iron ores are reduced in the furnace by means of carbon, and the spongy metal descends to the hearth, which preferably has a flat conical form, so that the metal may fall towards the said passages, whence it exudes or is drawn out into the reverberatory chambers. For this purpose tools may be inserted into openings at the lower part of the furnace. The said chambers are fitted with doors, and their roofs deflect the gaseous products upon the pasty or spongy metal, which is now formed into balls. These chambers are preferably constructed wholly of firebrick, and are framed up as usual by iron plates, framing pieces, and tie-bolts. The upper part of the furnace is carried upon columns, whereon mantle-plates rest. By means of the tuyères, oxygen or air may be forced into the furnace to regulate or vary its working.

The shape of the furnace may be more like that of an ordinary close-top blast furnace, when cast steel is to be produced. Then the hearth is a receiver or crucible, whence the molten metal is tapped and is led through a movable curved channel piece into the reverberatory chambers, wherein it is further treated. The crucible has other tapping holes for slag.

[*Drawings.*]

A.D. 1882, July 14.—No. 3354.

BENNETT, James Moss.—Smelting-furnace.

Instead of the gaseous and vaporized products passing off at or near the top as in an ordinary blast furnace for making pig-iron, they are caused to descend as well as the fluxes and reduced metal, which all pass through and react upon one another in the hottest zone of the furnace. The furnace has a closed top with a double gas trap or charging apparatus. A series of tuyères extend from the top to the bottom or reducing zone of the furnace, those toward the bottom being water-tuyères and preferably arranged at closer intervals vertically than those higher up. Each tuyère has a stop valve for putting it in or out of action, so that the working of the furnace is under

control, and irregularities may be corrected. The end of each tuyère pipe has a small window of mica or other material for inspecting the interior of the furnace. The ore may be calcined in the furnace and unprepared fuel may be used ; and the liberated hydrocarbons have to pass the melting zone, where a further supply of blast is introduced and the intense heat for smelting results, the quantity of hot blast entering at the uppermost set of tuyères only sufficing for partial combustion. At the lower part of the furnace the gaseous products escape through openings leading to flues &c. Water-blocks may be formed over and at the sides of the openings, the flues and openings being strengthened by plates, framing pieces, and bolts. The upper part of the furnace may rest upon columns with a mantel-plate thereon.

[*Drawing.*]

A.D. 1882, July 15.—No. 3366.

HADDAN, Herbert John. — (*A communication from the Mechernicher Bergwerks-Actien-Verein.*) — (*Letters Patent void for want of final Specification.*)—Smoke flues and chambers of metallurgical works.

To increase the quantity of volatile products (such as oxide and sulphate of lead) condensed in passing through these flues (the quantity depending on the length and superficial area of the flue), the flues may be provided with partitions, laid across and preferably at right angles thereto, and extending alternately from the bottom towards the top and from the top towards the bottom, so that the smoke or gaseous products must take a zig-zag course through the flue.

[*No Drawings.*]

A.D. 1882, July 17.—No. 3392.

GLASER, Friedrich Carl. — (*A communication from Fr. Burgers and Dr. C. Otto.*)—(*Provisional protection only.*)—Fire-bricks.

Coal or coke, or substances containing coal or coke, when ground fine and sifted, may be mixed with fireclay or other refractory binding-material, such as milk of lime. The mixture, after being kneaded with water, is formed into bricks, which

are dried on flues or in kilns until hard enough for use. They may also be burnt in furnaces with a reducing flame or exclusion of air, in order to make them harder.

[*No Drawings.*]

A.D. 1882, July 19.—No. 3426.

HADDAN, HERBERT JOHN. — (*A communication from the Mechernicher Bergwerks-Actien-Verein.*) — (*Letters Patent void for want of final Specification.*) — Dust-collecting flues or chambers.

The solid particles, suspended in the gaseous products of metallurgical works, sink very slowly in passing through the flues, so that much of this dust does not reach the floor before arriving at the chimney, and is consequently carried away. To increase the deposition of solid particles, the flue or chamber may contain one or more vertical series of fixed or movable plates, placed approximately horizontal or parallel to the direction of the draught, thus dividing the flue into several shallow channels, separated by plates of sheet metal on which the dust is deposited. The plates are preferably further apart near the bottom of the flue than near the top.

[*No Drawings.*]

A.D. 1882, July 19.—No. 3432.

BREWER, EDWARD GRIFFITH. — (*A communication from Georg Hoper.*)—Alloys for screw propellers.

The blades and bosses are formed of alloys of from 94 to 98 per cent. of copper and 6 to 2 per cent. of tin and phosphorus, or of 95 per cent. of copper, 2½ per cent. of tin, and 2½ per cent. of zinc, or other suitable proportions; the castings being subjected to forging or rolling.

[*Drawings.*]

A.D. 1882, July 25.—No. 3522.

LEFFLER, CARL JOHAN LAURENTZ. — Producing metallic wolfram, or alloys or carburets thereof.

The ore, oxides, or salts of wolfram may be charged into a furnace in layers alternately with charcoal or other carbonaceous

matter, fluxes or other ores or oxides of metals being added if desirable. Or the materials employed may be mixed together before being placed in the furnace, alternate layers of carbonaceous matter sometimes being used in addition. The construction of furnace is not defined, except that the chamber or part containing the materials operated on must be so constructed that it may be heated to the required degree without ingress of air or oxidizing gases, until the charge becomes reduced to metallic wolfram or its alloys or carburets (carbides).

[*No Drawings.*]

A.D. 1882, July 27.—No. 3563.

BEARD, Ambrose.—Regenerative furnaces.

The checquer work or reticulated structure constituting the regenerator, instead of being beneath, may be placed above the furnace proper. The regenerator is then carried on girders supported by columns, and is enclosed by a light iron or other casing, thus saving brickwork, facilitating cleaning and repairs, and avoiding loss of heat from damp foundations. Also, when ore is used in decarburizing steel, small particles are not carried by the gaseous current into the checquer work so as to injure the same, for, the said current being upwards, the particles fall before reaching it. A drawing of a furnace for melting steel and for other metallurgical operations shows the regenerator as connected with the ends of the melting chamber by vertical flues. The flues and valves for admitting the gas and air into the regenerator and for carrying off the waste products of combustion therefrom are shown placed upon the top of the regenerator. The said products on their way to the stack may descend through a preferably vertical tubular boiler, the heating of which may be aided (or, when the furnace is not at work, wholly effected) by burning gas within the boiler.

[*Drawings.*]

A.D. 1882, July 27.—No. 3571.

DALTON, George.—Breaking or crushing and sifting machinery.

(1.) Hard substances to be crushed are introduced between the fixed and the movable jaws of a stone-breaker, the movable

jaw being operated by two toggle levers set at different relative angles, so as to obtain a greater motion at the top of the jaw than at the bottom. There are wedge-shaped blocks capable of being raised or lowered behind the sliding toggle bearings to take up the wear of the jaw faces. The movable jaw may be worked by a horizontal lever or its equivalent, operated by connections with a shaft; a drawing indicates that the jaw is suspended from the end of this lever. Besides the comparatively large lateral angular reciprocating motion at the top compared to the bottom, an alternate downward reciprocating motion is imparted to the jaw, which thus powerfully and efficiently crushes.

(2.) The crushed substances pass from the jaws into a revolving screen or sieve, comprising an inner and outer perforated or reticulated casing, which may take the form of stout wire gauze fixed to a framing. The inner casing or screen has larger meshes than the outer to break the fall of the substance on to the fine screen. The framing may comprise light metal hoops with longitudinal tie pieces and an auxiliary wooden frame. Another casing, preferably with coarser meshes, may be arranged outside the said outer screen as a support thereto, thus constituting a strong compound screen. Other forms of screen, such as reticulated single screens rectangular or polygonal in cross section, may be used. The screen is fixed upon an inclined central revolving jointed shaft, one end of which is mounted in a bush, block, or slot, so that it can slightly rise and fall in its bearings as it rotates. This motion, which checks the clogging of the screens, is effected by a ratchet-wheel or equivalent, fixed on the shaft, and presenting different planes of elevation from its centre, and engaging or bearing upon the periphery of a runner or pulley mounted on a framing. The size of the meshes of the fine screen may increase towards the exit end to separate the crushed substances into different sizes, while the insufficiently broken pieces are discharged at the end of the screen and may be returned again through the machine by an endless chain of buckets.

[*Drawing.*]

A.D. 1882, July 29.—No. 3601.

VON NAWROCKI, GERARD WENZESLAUS.—(*A communication*

from Zeitzer Eisengieserei and Maschinenbau-Aktien-Gesellschaft.) —(*Provisional protection only.*)—Washing and separating strontium saccharate or other substances.

Strontium saccharate (or other substances needing washing from more soluble matters) is placed in boxes with sieve bottoms, preferably suspended in fork-ended rods guided in a star-shaped framing, and so connected by levers to a central shaft, having suitable adjuncts, as to receive an oscillating movement, at the same time that they are transported from tank to tank, each on a higher level than the preceding, in a direction contrary to the flow of liquid, maintained through connecting tubes. The sieves are so immersed in the washing liquid that the saccharate or other contents come into contact with such rinsing liquid as has dissolved the least of the adhering bodies.

[*No Drawings.*]

A.D. 1882, July 31.—No. 3610.

ALEXANDER, JOHN, and McCOSH, ANDREW KIRKWOOD.—Treating blast-furnace and other combustible gases.

Reference is made to the prior Specifications No. 4117, A.D. 1879, No. 1433, A.D. 1880, and No. 3785, A.D. 1881.

According to the present invention, apparatus, in which the gases are cooled by means of water to effect the condensation and separation of tarry and other condensible matters, may comprise a rectangular iron casing divided internally by parallel vertical partitions, which are placed so as to leave openings alternately at the top and bottom : thus the gases, admitted by an inlet at one end of the structure, can pass through the compartments in succession and in upward and downward directions alternately to an outlet at the opposite end. Wrought or cast iron pipes cross the compartments horizontally, and are connected by external elbow pieces into separate sets. Cold water enters these sets by vertical pipes at the outlet end of the structure, and leaves them by other pipes at the inlet end. Alternate sets of pipes are connected to one inlet and one discharge pipe, and the other alternate sets to other inlet and discharge pipes, cocks or valves controlling the flow of water through each set separately. The several rows or sets are preferably arranged so that the pipes of each row are opposite the spaces of the rows next it, in order to repeatedly subdivide the

streams of gases and improve the condensing action. At the bottom of each compartment, a discharge pipe leads into a main pipe to convey the condensed tarry matters to a tank. Large valves or doors act as relief valves, should the internal pressure become unduly great. A raised rim round the top of the structure forms a shallow trough for water, which, overflowing through holes in the rim, drips down the sides and ends of the structure, and aids the cooling action. Instead of using single plates or sheets for the said partitions, they may be made double and form thin spaces through which cooling water is passed.

Again, the casing may be a vertical cylinder, containing several vertical cylindrical compartments with connections at the top and bottom alternately, so that the gases may pass through them in succession. Each compartment contains vertical pipes, which are open at top and bottom to the space surrounding the compartments, and through which the cold water for condensation passes and fills the space in the casing not occupied by the compartments.

[*Drawings.*]

A.D. 1882, July 31.—No. 3636.

KIRKPATRICK, THOMAS SANDEN GODMAN.—(*Provisional protection only.*)—Separating ores from their gangue.

The ore (including ores containing gold and gold sulphides) is dry-crushed and separated by sieves into three or more sizes, according to the quality of ore and kind of matrix. Each parcel of different size is then "winnowed" by itself to separate particles of different densities. The ore is caused by its own gravity to be repeatedly presented in thin loose streams to a steady and continuous ascending current of air, drawn through the descending ore by exhaustion, and of a strength regulated to suit the kind of ore. The air currents carry off the less dense worthless particles, leaving the metallic constituents to be collected in one or more parcels, the concentrated ore being afterwards treated by any approved method to extract the metals present. The machine employed is fitted to receive, screen, feed, and distribute the ore to the air current: it has a series of upwardly directed exhaust passages, whereinto the ore falls and is conducted from one to the next by shoots and openings. A settling-chamber has several compartments,

wherein the more or less fine but dense particles, which may be partially separated by the air current, are deposited and may be automatically delivered into locked receivers.

[*No Drawings.*]

A.D. 1882, August 1.—No. 3646.

REDFERN, GEORGE FREDERICK.—(*A communication from Henry Wurtz.*)—Alloys of low melting points.

An alloy composed of two parts of tin with one part of lead is described, which will melt at about 360° Fahrenheit; also an alloy containing from 40 to 50 per cent. of bismuth which will melt at a temperature a little above the boiling point of water.

[*Drawing.*]

A.D. 1882, August 4.—No. 3708.

HADDAN, HERBERT JOHN.—(*A communication from G. Fernau & Co.*)—Metals, coating.

All metal surfaces coming in contact with acid may be coated with alloys of lead, antimony, and tin, alone or combined with other metals, or magnetic oxide of iron may be used.

[*Drawing.*]

A.D. 1882, August 4.—No. 3718.

LAKE, WILLIAM ROBERT.—(*A communication from Robert McCully.*)—Crushing, grinding, and pulverizing ore, grain, &c.

(1.) The frames of an ore crusher and pulverizer are adjustably bolted together. They have inclining sides, and are formed with bearings for a cam or eccentric driving shaft, and with dovetailed slots in which other frames move. The latter form bearings for rods or shafts carrying friction rollers. Crushing or working jaws are secured by screws or keys in holders, formed with longitudinal slots through which the said friction rollers pass, so that the holders will rest and partly move on the rollers. Through vertically elongated slots formed in one of the ends of the holders pass cams or eccentrics on the driving shaft, whereby on rotating the latter the jaws are reciprocated

longitudinally. The jaws have flaring corrugated crushing faces (the flaring providing for a hopper) and smooth and flat or partly corrugated pulverizing faces. Between the said inclining sides and jaw holders, two sets of antifriction rollers are placed. The rollers of the first set are sustained in a frame, and roll against the adjacent faces of the incline and of one jaw holder, as the jaws move, while those of the second set rest against the surface of another jaw holder and upon a series of double inclining plates secured to one of the first-mentioned frames. As one jaw is reciprocated longitudinally, the latter rollers move up and down the inclines and so cause this jaw to be reciprocated transversely to and from the other jaw. This transverse movement allows the jaws to separate slightly, so that the ore will gradually drop between the working faces and, after being finely pulverized, will fall out from between the jaws. A spring may be arranged to cause one jaw to hug its rollers and keep away from the other jaw, the contact of the jaws being effected only under the influence of the rollers moving up the inclines; another arrangement is described, in which springs tend to keep the jaws apart. To compensate for wear, adjusting screws are provided to raise or lower the second-mentioned frames, and with them the jaw holders. If lowered, the inclining sides of the framing cause the jaws to come together, which compensates for their wear; or the jaws may be set apart to use the mill for crushing only.

The transverse reciprocation of the jaw or jaws may be effected without using the inclines. The peripheries of the second set of rollers may be partly formed with sides or arcs of larger circles meeting in an apex. Such rollers may be supported in a frame and move independently, or the rollers may move together by the aid of arms and a connecting bar. Again, the rollers may have part of their peripheries formed with a surface of larger diameter; and a bar is connected to an eccentric on the driving shaft so that the rollers will be positively actuated during each reciprocation of the jaws. Toggle-levers (which may have anti-friction roller bearings) may replace the said rollers to effect the transverse reciprocation. The lateral movement of the jaws may be varied to obtain a quick or slow feed. Thus, the length of the inclines may be such that the rollers will pass up and down the same twice during each longitudinal reciprocation, hence the jaws will laterally recede

or open from and approach each other twice during such reciprocation ; and the pulverized ore falls out during such opening. Or the inclines may be such that the rollers will pass up and down only once during each longitudinal reciprocation, which provides for a slower feed. The reciprocation in different directions simultaneously produces an angular pressure on the ore, which is crushed and pulverized more readily and with less wear of the jaw faces.

The construction may be modified by supporting the eccentric shaft in bearings separate from the first-mentioned frames, a rod or link connecting it to the jaw holders. The first-mentioned friction rollers here pass above and below the jaw holders, which can be solid without slots. Again, one of the first-mentioned frames may serve both as a housing for the mill and as a jaw holder, one jaw being secured directly thereto, and only the other jaw reciprocating. Here only one eccentric and one of the two sets of antifriction rollers or toggles are used.

When the jaws are pulverizing the ore with their straight or vertical surfaces, they should be preferably taking their feed on their upper flaring surfaces, and when crushing between the latter, the pulverized ore should be making its exit from between the straight surfaces. When the rollers of the second set are at the apex of the inclines and the jaws have moved transversely to close together, their corrugations should register with each other, and when the rollers have returned to the bases of the inclines and the jaws have opened, their corrugations should not coincide ; during such latter movement the flaring surfaces are crushing the ore, but the arrangements may be varied.

When the screws holding the first-mentioned frames are loosened, the latter are pushed apart by the descent of the second-mentioned frames, and so the jaws automatically come together. Or the first-mentioned frames may be fixed, and the jaw holders may be provided with worm and gear mechanism for adjusting the jaws to and from each other. In another arrangement, the jaws have only a longitudinal movement, the inclines being dispensed with and the two sets of rollers, interposed between the frames and the jaw holders, being made cylindrical. The ends of the jaw holders may have removable face plates ; and as the faces of the jaws wear more rapidly than these plates, the latter are replaced by new or thinner plates to permit of the

jaws being brought together. The jaw holders may be composed of two parts to facilitate removal from the machine, and wearing parts in connection may be of steel.

(2.) Mills may be constructed with grinding discs, mounted upon separate shafts out of line with each other, and so that part of one grinding disc overlaps part of the other, the discs being closed or nearly so from their centres towards the peripheries of their lower parts, and opened from their centres towards their top edges to receive the feed. The grinding surfaces are made separate and secured to the discs by screw bolts. The rear side of each disc has a peripheral flange and an annular projecting ring with inclined face. Behind the discs there are movable frames, having grooved ends adapted to rest upon and slide on tongued bars or blocks secured to the main frame of the mill. The grooves and tongues may interlock with each other to permit the movable frames to serve as connecting bars for bracing the main frame at its centre. The movable frames have annular flanges on their front faces, also rings with inclined faces corresponding to the rings of the discs ; and these frames have bearings for the forward ends of the said shafts. The rings form ways for friction rollers, which are placed between the discs and frames. The frames are adjusted to and from the discs by means of screw rods and their connections, spring supports for the rods being sometimes provided. Collars are secured to the shafts immediately to the rear of the frames and hold the discs back against the friction rollers, so that the grinding-surfaces will be under full control of the screw rods, and irregular movement will be avoided. The rear ends of the shafts have bearings in pillow blocks secured to the main frame, the shafts carry driving-pulleys. The screw rods are in line with each other and with the overlapping parts of the discs, which are supported on each side of the shafts by the movable frames. As the screw rods cause the frames to approach each other, the resulting regulated pressure is equally distributed over the area of the discs. The discs being supported on each side of their respective shafts and rolling on the friction rollers, lateral strain on the shafts is avoided. The arrangement also dispenses with the need of end pressure on the shafts, so that almost all the power applied to the latter is exerted upon the grinding.

Besides the movement to and from each other, the discs may

have also a lateral and vertical movement. In this case the shafts and movable frames are secured on secondary frames pivoted to the main frame. The secondary frames have slotted ends for the passage of set-screws, on loosening which these frames may be raised or lowered to skew the shafts from a horizontal plane, causing the lower parts of the discs to come together while their upper parts recede from each other. To laterally adjust the discs and shafts, the tongued blocks are slotted for the passage of screws and are centrally pivoted to the secondary frames; and the pillow blocks, when loosened by other screws, can move laterally on a plate secured by bolts to the same frames. Then the movable frames and shafts may be moved laterally, the tongued and pillow blocks turning upon their pivotal connections to adjust themselves to this movement, whereupon the last-mentioned screws are tightened to hold the pillow blocks and maintain the lateral adjustment.

For automatically feeding the discs, a cam is located on one disc in line with a double pointed tripper, each end of which is raised alternately; and the motion is communicated to and vibrates a valve, having a comb-like lower edge. As the valve moves, feed takes place through the openings between the teeth and is conducted by a hopper tube to the discs. The feed may be varied by adjustments.

The claims include the combination, with grinding discs or plates arranged vertically or horizontally, the axes of which may or may not be in line with each other, of adjustable frames and antifriction rollers between the said plates and frames, and a centrally located force or screw feed.

[*Drawings.*]

A.D. 1882, August 5.—No. 3731.

BECKS, ARTHUR THOMAS.—Recovering tin from scrap tin-plate.

Instead of wholly using non-crystalline, or amorphous, carbonate of lime, in the form of chalk, to add to the solution of tin obtained by dissolving the coating of tin from the iron by means of acid, and in order to economize by avoiding the stirring and attention then required owing to the escape of carbonic acid gas making the solution froth, the inventor first employs fragments of marble or other crystalline carbonate of

lime, which will neutralize the free acid without the solution frothing materially, and (after removing the marble) precipitates the hydrated oxide of tin by means of chalk. The solution may be treated in a tank, into which a cage or perforated vessel containing the marble may be lowered by a chain, and the cage is raised from the solution at intervals to rinse the marble with water, so as to remove any adherent oxide of tin. When the marble ceases to act, the solution is treated with a mixture of chalk and water in the same or another tank. The precipitate obtained may be washed, dried, and reduced to metallic tin, or otherwise used.

[*No Drawings.*]

A.D. 1882, August 5.—No. 3735.

CUNNACK, Richard John.—Pulverizing ores, &c.

Of two horizontal rubbers of like size, the upper receives motion from an upright shaft revolving in a strong frame over the centre of the lower fixed rubber, the lower end of the shaft carrying a crank with a pin, which works in a central hole in a metal plate or bar applied across the upper rubber. Thus this rubber will be moved eccentrically upon the lower one, the unequal friction on the opposite parts of its circumference causing it also to revolve about the crank pin. This axial revolution may be varied by gearing attached to the rubber and frame, preferably by a wheel with internal teeth, fixed to the frame and in gear with a toothed pinion attached to the rubber. The double motion increases the grinding effect, and keeps the rubbing or grinding surfaces in a uniformly effective condition. Apertures, in and around the centre of the upper rubber, admit a small stream of water carrying the ore for treatment, which should be first crushed to pass through sieves of nine holes or more to the square inch. Over the edge of a surrounding shallow pan the ground ore is expelled by a flush of water.

The rubbers may have separate renewable wearing plates or shoes of very hard metal. These may be solid, but preferably have perforations or cavities of any shape or size regularly or irregularly distributed throughout their substance, so as to produce numerous cutting edges and treat hard, rough material more effectively. Sometimes the cavities may be partly or

wholly filled with wood, cement, or like softer material, to prevent the ore from passing through too quickly. A bed-plate may be fastened to a foundation at the base of the machine, having hollows in its upper surface into which projecting studs on the back of the shoes fit. The upper or moving portion may be made in the shape of a shallow circular pan with openings in the bottom corresponding to the projecting studs on the back of the shoes to admit of their ready insertion. Sometimes the rubbers may be of hard stone, or slag, or scrap iron or steel, built with cement or (preferably wooden) wedges into iron rings. Cast-iron centres may provide for feeding through, and support the bar containing the hole for the crank pin.

In treating gold or silver ores, quicksilver is placed in the pan, which surrounds the bottom grinder and which may be heated by a steam jacket. The upper grinder will sweep off particles floating on the mercury, continually exposing fresh material to its action without disturbing it so as to cause waste by attrition. The quicksilver may be drawn off or replaced without stopping the machine. Amalgamated copper plates or mercury troughs are set in front of the discharging flush to intercept escaping material.

[*Drawing.*]

A.D. 1882, August 11.—No. 3831.

HUNTINGTON, Alfred Kirby, and KOCH, Walter Edward.—Extracting precious metals from their ores.

The ore (preferably crushed to expose a large subdivided surface) or tailings for treatment may be charged into, by preference, a rotative gas furnace which may be of the regenerative kind, means being provided for supplying an oxidizing or deoxidizing flame. The charge is sufficiently heated in the oxidating flame to decompose without fusing the ore, and to separate the greater part of the sulphur or other impurity present. Then, on lowering the heat, metallic lead or easily reducible lead ore or compound, such as oxide or carbonate, is introduced. The lead, when molten, takes up the precious metal as an amalgam or alloy, and may be afterwards separated from it by cupellation. The resulting litharge can be used to form fresh alloy.

It is preferred to calcine the ore under the oxidating flame,

in the rotative furnace, and to transfer it, while hot, to a close vessel or pan, set in a flue to receive heat preferably from a gas flame. A revolving agitator keeps the ore in agitation over a quantity of molten lead in the pan. A pipe leads from a gas producer to the upper part of the pan, and an outlet pipe carries the gas from the pan to the fire or furnace for heating the pan, through which carbonaceous or deoxidating gas thus circulates. After the molten lead has taken up the precious metal, the agitator throws out the residue of the ore through a side door. The process may be continued by introducing fresh charges successively until the lead is sufficiently saturated, when it is run off by a tapping-hole to be cupelled, or the previous metal may be otherwise separated. Finely-divided amalgamated metal, ejected from the pan with the ore, is to be dressed out in the usual way.

The lead may be replaced by other metal fusible at a moderate heat, such as tin, antimony, or zinc, or alloys or mixtures thereof: an alloy of lead and antimony is recommended.

[*No Drawings.*]

A.D. 1882. August 12.—No. 3858.

WATSON, David.—Treating solutions used for purifying copper ores and precipitate.

Reference is made to the prior Specifications No. 5271, A.D. 1881, and No. 1305, A.D. 1882.

The solutions, proceeding from the purifying treatment of copper precipitate or ores by alkaline compounds in accordance with the prior Specifications, may contain alkaline arseniate, phosphate, and carbonate, and are to be heated or boiled and agitated under the ordinary or increased atmospheric pressure, with calcium hydrate in excess. Thus the alkaline arseniate and phosphate (and sometimes carbonate) are decomposed, insoluble calcium arseniate and phosphate being produced and afterwards separated from the alkaline hydrate solution by filtration, which also removes insoluble calcium hydrate and carbonate. The filtered solution may now be used again for purifying the precipitate or ores.

[*No Drawings.*]

A.D. 1882, August 15.—No. 3891.

ÜLSMANN, HERMANN.—Basic refractory materials.

In making such materials from caustic alkaline earths or their carbonates, such as lime or magnesia, the dead-burning, to remove carbonic acid, water, &c., and produce a dense mass, may be facilitated by the use of ferrous alkaline earths, natural (like magnesium ferric carbonate) or artificial, or by an admixture with the alkaline earths of small fragments or powder of iron in metallic, oxidized, or other state (free from silicic acid). The alkaline earths combine with avidity at high temperatures with oxide of iron, and are converted into a hard, splintery, granular, brittle, shrunk mass, which crumbles into small pieces. This facilitates reduction for the subsequent processes ; only a part should be ground fine, while another part should be left in granules of from 0·039 ins. to ·019 ins. in size or larger and with angular edges, in order to produce coarse-grain bricks, &c., with the aid of binding materials. A little iron will suffice, but more may be used.

The burnt and comminuted material is to be mixed with about 5 p. c. of alkali carbonates or caustic alkalies as binding material, and with sufficient tar or other viscous hydrocarbon for uniting the warmed mixture under pressing or stamping to a solid mass for producing bricks, vessels, &c., or linings for metallurgical apparatus, freedom from water being essential.

The alkaline earths may be dead-burnt in reverberatory or shaft furnaces at as high a temperature as possible, and with the avoidance of ashy constituents containing silicic acid.

If the bricks &c., are to be burnt before use, they must be piled in the furnace with pieces of previously burnt material, so that as the tar becomes fluid, they cannot sink together. The furnaces or kilns must yield a high temperature, and have a basic floor for lime bricks.

Fragments of burnt material or used linings can be ground, newly formed with tar, and burnt again.

If the alkaline earths be dead-burnt with the addition of chlorides, with or without fluorspar, steam should be introduced to drive off the chlorine. Small quantities of caustic alkalies or their carbonates accelerate the burning.

[*No Drawings.*]

A.D. 1882, August 16.—No. 3908

SUTHERLAND, WILLIAM SEDDON.—Gas furnaces.

Reference is made to the inventor's prior Specification, No. 3864, A.D. 1882, which relates to the manufacture of malleable iron by forcing thin streams of heated carbonic oxide gas and air through molten cast iron.

The present invention partly relates to a heating furnace or hearth, which combustible gases and air enter at opposite sides or ends alternately, either end being alternately feed and escape. According to the description and drawings, gases from a main are driven through a water-cooled tuyère at one end of the furnace, whilst heated air from one of the regenerators passes up through a passage to cause or complete the combustion ; two regenerators are shown beneath the furnace, and one communicates with each end of it. The currents through the regenerators are reversed by the valve described below or in the ordinary way, and regulating valves may be supplied as well, whilst the gases are simply turned on and off at each end alternately.

The invention also relates to the construction of gas producers, regenerators and other apparatus being in connection therewith. A slide valve is provided for opening and closing passages in connection with producers and regenerators. The valve seat has three ways or passages, the two outside ways being similar and each leading to a regenerator or other place : the centre way communicates with a gas delivery main. The orifices of these ways form a smooth surface, on which the valve with its smooth surface slides, forming a gas-tight joint or nearly so. When one outside way communicates with the atmosphere, the other communicates with the centre way. The valve (which is moved by a lever) and valve seat are cooled by water or otherwise, and may be used to reverse very hot currents of air and gas. The inside surfaces in contact with the latter may be coated with refractory and non-conducting material so as to prevent loss of heat. This arrangement of reversing valve may be well used in connection with the prior invention. The sliding surfaces may be circular, and various combinations may be made of the ways and passages in the seat and the valve cavity, and more cavities and ways may be formed.

[*Drawings.*]

A.D. 1882, August 18.—No. 3958.

BENNETT, JAMES ALFRED BERESFORD.—Purifying copper and its alloys.

This is effected by introducing about one-twentieth p. c. by weight of metallic sodium into the molten metal or alloy. The sodium, in a casing of blotting paper or other substance not easily consumed by the metal, is plunged to the bottom of the molten metal in a crucible or mixing vessel, and is immediately volatilized, spreading throughout the metal, which when cast is freer from pores and sounder: it also becomes brighter in colour, but its nature is not materially altered.

The invention also relates to casting copper and other cylinders &c.

[*Drawing.*]

A.D. 1882, August 19.—No. 3972.

BLENKINSOP, GEORGE HENRY.—Utilizing the heat in molten or semi-molten slag or other substances for calcining, agglomerating, sintering, or binding together the same with other substances; and thereby facilitating the after-treatment thereof for extracting, producing, or purifying metals or metallic properties present.

Various ores and metallic substances, in a state of fine division or otherwise, may be partially calcined and agglomerated by intimate mixture with slag or other substances, running in a thin stream into a suitable vessel from a furnace or other apparatus. The mixture is afterwards treated for the extraction or otherwise of the metals therein.

The slags or other material, produced from copper, silver, gold, lead, zinc, cobalt, nickel, or antimony smelting, may be smelted (as well known), preferably in a blast furnace, with an ore or material containing the same metals or any of them; whereby the metals in the slag are profitably extracted, and the slag is brought into a suitable state for carrying out the invention: which includes the intermixture of molten slag with lime, &c., to facilitate the extraction of iron from the slag.

[*No Drawings.*]

A.D. 1882, August 19.—No. 3978.

IMRAY, John.—(*A communication from James Cosmo Newbery, John Lister Morley, and Barry Cleveland.*)—Furnaces, and treatment of ores.

Especially ores, which form oxides or compounds reducible by heated charcoal, like ores of antimony, bismuth, copper, tin, and zinc, may be treated. Oxides may be produced by treating sulphides, arsenides, and other oxidizable ores on a hearth. When the ore fuses easily, like sulphide of antimony, the bed of the hearth is perforated all over to allow the fused sulphide to pass through to a solid bed beneath; where it is converted into oxide, or it can be drawn off as crude sulphide. From not readily fusible ores, the oxide may be made in any ordinary way. The oxides, natural or artificial, are converted into metal by smelting them in a furnace, with a downdraught through the oxides and through the carbon used. The heat from one fire may be utilized for liquating the ore, perfecting the oxidation, and producing the metal. Drawings show a furnace with a fireplace, separated by a bridge from a space containing refractory tubes or cylindrical chambers, beneath which is a sloping bed; and this space leads into the liquating or oxidizing part of the furnace. The perforated hearth is supplied through doors with the ore, and the doors are closed. The said tubes are charged first with a thick layer of carbon, like wood-charcoal, and then with alternate layers of the oxide and of sufficient carbon to reduce it, fresh layers being added as the contents descend. When there is no more material to treat, caps are put on the tubes to prevent escape of gases and waste. The hot products of combustion from the fire play around the tubes and then pass into the liquating chamber. When fusible sulphides are treated, they run through to the solid bed over which the hot gases then pass and finally throgh an outlet flue to precipitating flues or chambers of the usual kind. The heated current carries with it the oxide formed on the bed, its formation being aided by admitting air by a door or heated air by pipes. The metal, resulting from the reduction of the oxide in the tubes, passes through the carbon at the bottom to the bed beneath, whence it is run through a tap-hole into a receiver. Combustible gases or liquids may be used more or less in place of the solid carbon

in the tubes, as long as the layer of carbon remains in the bottom.

[*Drawing.*]

A.D. 1882, August 19.—No. 3987.

KENYON, HARTLEY.—(*Provisional protection only.*)—Obtaining zinc and other products.

Galvanizers flux, with or without previous grinding or crushing and lixiviation, is charged on the floor of a roasting furnace, preferably having a slanting floor, say, about 50 feet long heated by sub-flues, and a crown also heated by flues, the depth from floor to crown varying from 9 to 15 inches. To help the operation there is burnt in the roaster sulphuretted hydrogen or the gas obtained by distilling slack coal, or both gases; and highly heated air is admitted, which has been passed through the bridges and parts requiring to be cooled. The air is deoxidized and the liberated nitrogen combining with hydrogen forms ammonia. Ground coke or sawdust manure is sometimes added in the furnace to aid the operation and regulate the flow of the charge down the inclined bed. Chlorides of ammonium and zinc are volatilized and delivered into an absorber. When desiring to obtain spelter, the charge is withdrawn from the roaster when the chlorides have been driven over, but when a larger proportion of zinc compounds is wanted, the roasting is continued until the zinc has passed over into the absorber.

The invention, which includes the treatment of other matters, extends to other products including zinc paint.

[*No Drawings.*]

A.D. 1882, August 21.—No. 3999.

JOHNSON, GEORGE.—(*A communication from Thomas Gibb.*)—(*Provisional protection only.*)—Treating copper precipitates.

When a solution of caustic soda or potash is used to extract arsenic from copper precipitates in the form of arseniate of soda or potash, the solution may be afterwards digested on slaked lime, whereby the soluble arseniates are decomposed: and when the resulting arseniate of calcium has settled, a solution of caustic soda or potash is left suitable for use again in treating copper precipitates.

[*No Drawings.*]

A.D. 1882, August 22.—No. 4011.

ROBINSON, Joseph, and ROBINSON, Thomas.—(*Provisional protection only.*)—Furnaces.

To combine the advantages of both furnaces, a cupola or stack for containing metal or ores to be melted or smelted is constructed over a refining or reducing furnace, heated gases and products of combustion flowing from one to the other through intercommunicating passages. The refining or reducing furnace may be in the form of a tank with a semicircular bottom, and the cupola hearth is made by an arch or arches covering the centre of the tank. Solid, liquid, or gaseous fuel is used, with or without heated air or other blasts.

[*No Drawings.*]

A.D. 1882, August 22.—No. 4018.

WILLIAMS, Benjamin.—Removing grease from tin plates.

The plates are fed to rolls fitted with beaters, which are made to feather, so that they open to receive a quantity of bran, which is squeezed out as the beater is closed, and deposited on the plate, just at the point where the plate is crossing the rolls. The rolls are rotated in a reverse direction to that of the feeding rolls. The plate is then passed between fluted bran cleansing-rolls and dusting and polishing rolls, which last serve as delivery rolls.

The bran is fed to the rolls and upon the plate, from a hopper provided with a vibrating screen and controlling plates, and the spent bran falls into a trough, from which it is carried by a screw and elevator back to the hopper.

[*Drawing.*]

A.D. 1882, August 29.—No. 4128.

TOY, John, and STEPHENS, Samuel Henry.—Grinding ores, cement, &c.

As improvements upon the prior Specification No. 677, A.D. 1872, which relates to the same subject, the present inventors form the bottom of the pan of a concave ring form and with a flat bottom well. The bed is formed correspondingly, and is cast in segments so that any worn piece may be removed.

By making tbe bottom concave, the power of specific gravity acts in opposition to centrifugal force, so that the ore is held longer under the grinding surface and will be ground finer than by flat bottomed machines.

To introduce the feed near the centre of the machine, a circular trough having a perforated concentric division is arranged round the shaft of the muller, and the ore is fed by pipes into the outer division of the trough. Several branch pipes preferably convey it from the outer division under the shoes or rubbers. From the inner division of the trough a pipe conveys any water to the bottom or well of machine. The branch pipes should be long enough to cause the ore to enter near the upper or outer side of the concave surface or bed. The ground ore is carried away by pipes from the well of the pan.

The periphery of the shoe, instead of being a true circle, is made of an involute curve. A piece of metal is cast or bolted on the whole length of the front part of the shoe, also a piece at the extremity of shoe to prevent the ground ore from being thrown against the side of the pan, and a further piece on the top of the shoe. Instead of attaching the shoe to the arm of the muller by wedges, the inventors use a dovetail catch on the top of the shoe which takes into a corresponding slot on the arm of the muller ; and by reversing the machine the shoes will drop out, thus saving the cutting out of old wood wedges.

For regulating the pressure upon the ore being ground, the inventors take off any required weight from the grinding surface by means of a lever acting upon the muller shaft. One end of the lever is fork-shaped, the prongs of which pass on either side of the shaft of the muller ; to the other end of the lever weights are hung according to the degree of pressure to be taken off the grinding-surface. A suitable stop is placed on the muller shaft to cause the prongs of the lever to lift the muller when the lever is depressed by weights or other means : the muller may be entirely lifted.

Cast-iron rings, made in halves with dovetails, may be applied, without any derangement, to top of the muller to counteract the wear of the shoes and increase the weight on the rubbing-surfaces.

By discharging the liquid at the bottom and not keeping a large quantity of water at one time in the pan, material, which

would be too light to sink in the water, will now pass under the grinding-surface. And by closing the discharge pipe, heavy coarse stuff may be ground and discharged over a perforated cover.

[*Drawings.*]

A.D. 1882, September 12.—No. 4349.

NOLF, ANDRÉ LÉOPOLD.—(*Provisional protection only.*)—Obtaining sodium.

A cold concentrated solution of chloride of sodium is to be decomposed by electricity. A wooden vat or trough, with an iron bottom, has an iron cover, which can be hermetically bolted to the vat by the aid of an india-rubber ring. A central vertical iron shaft passes through the cover, and has a wooden continuation enclosed at the bottom by an iron sleeve, the upper part of which is cross-shaped to support four wooden arms. The iron shaft revolves freely in a stuffing-box, and there is a bearing fixed to the bottom of the trough, which contains a layer of mercury forming the negative electrode of the decomposing bath. Pieces of gas-retort carbon, which form the positive electrode, are fixed through the said arms and are shown in a drawing as dipping into the mercury. A copper wire contained in a small glass tube connects the mercury to a dynamo-electric machine, from which another wire leads to a metallic brush, having an insulated support, and impinging against the circumference of an insulated copper ring on the iron shaft, the electric current being conducted from this ring to the upper part of all the carbons by an insulated platinum wire which fits into a groove in the iron shaft. There are also inlet and drawing-off pipes for the mercury, a pressure gauge, a leaden tube for carrying off the chlorine gas which is disengaged, and a wooden partition termed a depolarizer (because the stirring of the solution, which it produces when the agitator is in motion, prevents bubbles of gas from adhering to the electrodes). Vulcanized india-rubber tubes, passing through the cover and perforated near their bottoms, are kept filled with chloride of sodium to maintain the concentration of the solution. A varnish, not affected by the chlorine, is used for coating parts of the apparatus. The trough being charged with the solution of chloride

of sodium, the electric machine is put in motion, the shaft is slowly rotated by gearing, and the decomposition commences. The liberated sodium is attracted to, and forms an amalgam with, the mercury, whereby it is preserved from any decomposing action on the water. The amalgam is drawn off, and the sodium contained in it is utilized as required.

[*Drawing.*]

A.D. 1882, September 15.—No. 4396.

GUYE, AUGUSTE.—(*A communication from Philippe Auguste Guye.*)—Alloys of gold.

A series of alloys of gold with aluminium bronze, or with other alloys of aluminium and copper may be obtained of different standards, of a fine gold colour, malleable, ductile, hard, and elastic, and less oxidizable and of lower density than the alloys of gold generally used. The alloys may be made in earthenware crucibles not containing so much silica as would render the alloy brittle (in consequence, probably, of the formation of aluminic silicates or silicide of aluminium). The gold may be alloyed with aluminium bronze, or with a mixture of copper and aluminium, or first with copper and afterwards with aluminium. The aluminium bronze should contain about 10 parts of aluminium and 90 of copper. The aluminium in the bronze may be increased to about 15 p. c., the alloy of gold becoming paler and harder with this increase ; to obtain a redder and more malleable alloy, it may be lessened to 5 or 4 p. c., or even lower but in that case the alloys will be more oxidizable at a red heat.

To prevent the aluminium becoming contaminated by the earthen crucible and becoming oxidized by too long heating, it should be added (either fused or not) to metals which are already fused. Thus :—(1.) In an ordinary earthen crucible, containing gold in fusion, the alloy of aluminium and copper is added : mixing is effected and casting into ingots.

(2.) The aluminium is added to a mixture of gold and copper in fusion.

(3.) The gold is first cast in the form of a crucible, which is then placed within an earthen crucible and heated. Before the gold begins to melt, there is placed in it the aluminium-copper

alloy or unmelted mixture of copper and aluminium, and the whole is fused.

(4.) When gold and copper begin to melt in an earthen crucible, there is placed above it an iron crucible, containing the aluminium and having a hole in the bottom, so that the aluminium, as it melts, will fall into the molten mixture of gold and copper.

(5.) The aluminium, melted separately in an iron or earthen crucible, is poured into an earthen crucible containing the melted gold and copper.

Some of these methods may be followed in preparing the aluminium-copper alloy.

[*No Drawings.*]

A.D. 1882, September 15.—No. 4397.

WEKEY, SIGISMUND.—(*Provisional protection only.*)—Ore-crushing and amalgamating machine.

The lower part or cast-iron disc has circular concentric grooves, with outer edges rather higher than the inner edges to allow the crushed material, sludge, or tailings to pass inwards towards a central outlet. Round the outer edge of the first groove is a water pipe with a perforated inner side for water to flow into the outer groove. Small holes, closed by plugs, on the bottom of the three parallel grooves communicate with an inclined channel, passing through this disc and ending in a tap for draining off the amalgam and quicksilver when required. Hard chilled-iron balls crush the ore in the grooves.

The under surface of an upper disc has corresponding grooves; and its inner surface has also projections to propel and separate the balls from one another. This disc rests on the balls, and has teeth on its periphery in gear with a driving-wheel and pinion. This disc, which is weighted to increase the crushing power, is kept in place by a perpendicular shaft. It has a groove or circular feeder; whence the ore falls through apertures into the outer groove of the machine and is crushed by the balls on which the upper disc revolves: and the amalgamating of the gold commences. When the amalgam is to be removed for treatment, the upper disc may be lifted by a screw-jack, and the said plugs are lifted to allow the amalgam to flow down the channel.

Without interfering with other crushing and amalgamating machines, this machine will save much fine gold and quicksilver otherwise lost with the tailings &c. ; or it may be used alone.

[*No Drawings.*]

A.D. 1882, September 15.—No. 4400.

ABEL, Charles Denton.—(*A communication from Friedrich Albert Reinecken and Ludolf Poensgen.*)—Separating tin from scrap or waste metal.

A series of cylindrical drums revolve side by side on horizontal axes, and their perforated metal sides have large central openings. The drums are supported on their shafts by internal radial arms, situated at one side and having inclined branches to the other or free side, which is adjustably connected thereto by bolts passing through slotted holes. Bars, placed close together radially, pass loosely through holes in the free or adjustable side and in the opposite side or arms ; and constitute grate-like scoops or blades for raising the scrap metal as the drum revolves. Plates may be also inserted behind the bars to hasten the delivery of the scrap metal from the drum and the shifting of the adjustable side, so that the bars assume a more or less oblique position, also regulates the delivery. Inclined shoots connect the different drums, so that a hinged flap at the upper end of each shoot projects obliquely into the interior of a drum, catches the scrap metal carried up by the scoops, and automatically conveys it down the shoot into the next drum. When turned on its hinge, the flap prevents the delivery of the metal into the shoot.

In the first drum, the scrap metal is cleansed from dirt &c., by heated soda lye contained in a vat, in which the drum is immersed to about half its diameter. In the second, adhering impurities are washed off by a stream of water passing through the drum. In the third and subsequent drums, which are similarly immersed in a lye of hydrate of soda or potash in water containing an excess of oxide of lead (massicot), all the tin on the scrap metal is dissolved while lead is deposited, the vats being heated by fires or by steam jackets or pipes to keep the lye about boiling. Granular metal should be placed in the drum to scour the scrap metal, on which the lead is partly deposited ; and that deposited in the vat is removed by hinged

scrapers on the outside of the drum. The deposit is re-oxidized in a heated retort for use again. The lye saturated with tin is removed and clarified, and may be diluted and treated with carbonic acid to precipitate the tin as oxide. The carbonate of soda left may be separated from the liquor by centrifugal action and washing, and then treated with milk of lime to produce caustic soda lye for use again. There is a last drum for washing the residual scrap metal.

[*Drawing.*]

A.D. 1882, September 20.—No. 4471.

PICKFORD, Tom Newman.—(*Provisional protection only.*)—Tin plates, cleaning.

A substitute for bran, consisting of wood sawdust, which is dried and afterwards roasted or charred, and then ground and mixed with chalk or other fine absorbent dust.

[*No Drawings.*]

A.D. 1882, September 20.—No. 4474.

LACKERSTEEN, James Frederick.—(*Provisional protection only.*)—Apparatus for washing and drying china clay and other substances.

The washing-apparatus consists of a frame work, preferably cylindrical, covered with wire gauze, to the upper surface of which is attached a pipe leading to an air pump, and at the lower end is a pipe opening downwards. This sifter is immersed in the water in which the clay is suspended, the lower pipe is closed, and the air being exhausted, water rushes in carrying with it the finely-divided clay. The lower pipe is then opened and the liquid flows away. If the apparatus be placed at a height of 35 to 36 feet, a continual stream will flow as long as the vacunm is maintained.

[*No Drawings.*]

A.D. 1882, September 25.—No. 4559.

GILMOUR, Thomas, and GILMOUR John.—(*Provisional protection only.*)—Furnaces.

To obtain an air supply under better control, a casing may be fixed on metallurgical and other reverberatory or heating furnaces, so as to cover and enclose a small space in front of the fire-door and ashpit, opposite to which the casing is fitted with doors. Air from a fan or blower is forced into the casing, and the usual arrangements for regulating its passage above and below the firebars are retained. When feeding fuel, the upper door of the casing and ordinary fire-door are opened, and the air supply is sometimes automatically checked, or the air may then pass outwards, or the fire-door may fold down and cover the opening which gives the air access to the top of the fire. A damper in the exit flue or chimney should control the exit of the fire gases and maintain a slight pressure in the fireplaces and flues.

[*No Drawings.*]

A.D. 1882, September 26.—No. 4569.

PITT, SYDNEY. — (*A communication from Charles G. Francklyn.*)—Compounds for making furnace linings and fire-brick.

(1.) Silica or river sand, practically free from loam, oxide of iron, or other fluxing impurities, is mixed with good fireclay, slaked or hydrated magnesian lime or magnesia, or calcined sulphate of lime in such proportions that the mixture contains 5 per cent. by weight of alumina, magnesian lime, magnesia, or sulphate of lime, as the case may be, enough water being added to produce a thick mortar. The mortar may be used as a lining for converters or walls and hearths of furnaces; it may be rammed in between a core or former and the walls, the core being withdrawn when the lining has set, or the compound may be moulded into bricks, which are air-dried or burnt in a kiln. The compound containing sulphate of lime or plaster of Paris should not be used for parts of furnaces, from which iron when under treatment would take up sulphur. The substances are used in a fine state of division; and very refractory and durable compounds, which neither expand nor contract at the highest temperatures, are obtained.

(2.) Ninety-parts of finely-divided iron ore (iron sand, freed from impurities by magnetic separators or otherwise, or

other very pure ores) are mixed with ten of slaked lime, magnesian lime, or magnesia, and enough water to form a thick mortar, which may be used for lining walls and hearths of puddling furnaces (being sometimes applied with a trowel like plaster), or be first made into bricks.

(3.) Ten parts of oxide of iron are mixed with ninety of magnesian lime and water to form a thick mortar; which is moulded into brick to be dried and kiln-burnt for lining furnaces, converters, &c.

(4.) Ten parts of fluor spar are mixed dry with ninety of hydrated lime or magnesian lime, and the mixture is very highly heated until it solidifies. The mixture may be made into blocks with water and dried, before being thus heated. The solidified mixture is afterwards finely ground and mixed with more (*i.e.* from twice to five times its bulk) of the same mixture; water being added to make a thick mortar to be moulded into bricks, which are air-dried and highly burnt. When magnesian lime is used, the compound may be applied as mortar for lining the furnace.

(5.) Vegetable substances (from which sugar or starch may be extracted) and water may be used as a binding-agent for silica, with or without other ingredients. One part of glucose to from $1\frac{1}{3}$ to 10 parts of water may be mixed with silica into a thick mortar for lining furnaces &c., or for moulding into brick. Glucose may be replaced by starch, dextrin, mucilage, gum-arabic, or molasses, dissolved in water. Also corn or rice flour, oat, bean, or pea meal, wood pulp, potatoes, or like substances, mixed with water to a thin paste, may be substituted: again, curd of milk or lactic acid without water may be used.

(6 and 7.) Alumina, lime, magnesian lime, or magnesia may form part of the compounds referred to in the last paragraph: or they may contain 10 parts of oxide of iron to 90 of silica. The claims also extend to compounds containing 90 parts of oxide of iron to 10 of lime or magnesian lime; and some are mentioned as containing water without either vegetable matter or curd of milk or lactic acid.

(8.) The linings or bricks may be coated with a mixture of 1 part of glucose to $1\frac{1}{2}$ of water (or with dextrin, starch, gum-arabic, mucilage or molasses, dissolved in water, or corn flour, grain meal, or wood pulp, mixed with water to a paste) with or

without lime, magnesia, or magnesian lime. The coating, which gives a hard surface and power to better withstand concussion and heat, is preferably applied when the lining or bricks have been wholly or partially air-dried, and then thoroughly dried or burnt in kilns.

Information is given as to variations in the proportions of ingredients used, and as to the particular scope of the invention.

[*No Drawings.*]

A.D. 1882, September 26.—No. 4570.

NEWTON, Alfred Vincent.—(*A communication from the Sanford Universal Fibre Company.*)—Reducing-machinery.

The invention is described with reference to machines for treating fibrous matters, but may be embodied in machines for reducing or pulverizing ores, iron slag, &c., and generally for reducing, washing, rubbing or separating various vegetable or mineral substances.

A cylinder may consist of a metal skeleton body, or of two or more drums or wheels, and a covering of metal or other slats or staves extending lengthwise thereof, in combination with a concave or bed composed of sections, bars or staves. A feed table is provided, with or without feed rolls ; and the fibres are passed between the cylinder and bed, both of which have fluted, grooved, ribbed, or otherwise roughened surfaces. The cylinder is placed slightly eccentric to the bed, the intervening space being wider on the feeding-side than on the delivery-side. The cylinder shaft is supported in bearings, which are pressed down by india-rubber blocks or other adjustable springs, while the sections of the bed are supported at the ends on flanges or bearing strips of india-rubber, inserted in grooves in a tank, which, according to a drawing, contains the lower part of the cylinder and bed, and is provided with an overflow, thus, the cylinder and bed can yield slightly in opposite directions. A gear-wheel on the cylinder shaft engages with a pinion on a second shaft, which is hung in bearings in arms loosely fulcrummed on the cylinder shaft. The driving shaft carries a crank disc having a long wrist pin, the revolution of which produces a reciprocating motion of the second shaft, its pinion, and the said arms, through pitman rods which are connected together by a pin.

A wheel on the latter pin gears with a wheel on the second shaft and with a pinion on the said wrist pin. Thus the cylinder will be rotated alternately in opposite directions ; the movement of the pinion on the second shaft by the wrist pin or crank in one direction will accelerate the rotary motion of the cylinder, and the reverse movement of the pinion will produce a retardation : but as the motion is greater in one direction, the cylinder will have a progressive rotary motion in that direction and will carry forward and deliver the matters treated. Separated matter may pass out between the sections of the bed or through perforations.

In another machine the cylinder and bed are fluted or grooved in the direction of rotation of the cylinder (instead of at right angles thereto) but the cylinder may have several longitudinal grooves. The cylinder shaft is here mounted to turn and slide longitudinally in a bearing near one end, while its other end carries a worm-wheel which is adapted to rotate in a bearing without moving longitudinally and which allows the said shaft (though locked to it) to move endwise freely. A driving shaft carries a worm or screw to engage with the worm-wheel and thus rotate the cylinder. At the other end of the machine is a rock shaft, carrying one downwardly and two upwardly extending arms, which latter are connected by rods to a loose collar, fitting between two fast collars on the cylinder shaft : while a rod connects a crank on the driving shaft to the downwardly extending arm on the rock shaft. Thus the cylinder will have a constant rotary motion in one direction, and also a reciprocating longitudinal movement or end chase.

The machine may have more than one cylinder and bed : and cylinders might be replaced by conical, barrel-shaped, or other constructions with circular transverse sections, the beds being of corresponding shape. They may be placed either horizontally, upright or inclined. The actuating-mechanism may be varied, and the motions of the cylinder also modified.

[*Drawing.*]

A.D. 1882, September 26.—No. 4580.

LAKE, WILLIAM ROBERT.—(*A communication from Henry Renner Cassel.*)—Using electrolysis and dialysis in decomposing alloys &c.

The refining of base bullion is described. To prevent the metals dissolved from the alloy or bullion anodes from coming into contact with and being deposited on the cathodes of the apparatus, a dialyser is employed to ensure the separation of the anode solution from the cathode solution, or at least to prevent the dissolved metals from passing through. In a generally rectangular tank which forms the electrolysing bath, the anodes of bullion (composed of, say, copper, silver, and gold) are supported by cross-rods, held at one end by a bar in connection with the positive pole of an electric generator, while the cathodes, which may be plates of carbon, platinized carbon, or metal like copper, are suspended in recesses in frames, which are held at one end by another bar connected to the negative pole of the generator, the other ends of the said cross-bars and frames being insulated, and the upper edges of the dialysing cells (which contain the cathodes) being attached to the frames. The dialysing cells are made of a colloidal substance or any material which offers a barrier to the metal salts in solution under the action of an electric current ; wood being preferred. These cells are secured to flanges on the under sides of the frames, which may be wholly of metal ; or there may be a metallic connection. The anodes are suspended in a sulphuric-acid solution of about 7 degrees Beaumé, and the cathode cells are filled with any solution possessing considerable electric conductivity, as sulphuric-acid solution of about 10 degrees. When an electric current is passed through the two liquids and the cells, oxygen is freed at the anodes and attacks the copper and silver ; which are dissolved by the acid in the anode solution, while hydrogen is freed at the cathodes, the cathode cells requiring only fresh acid solution at intervals. The anodes are rapidly attacked when a strong current decomposes enough water to cause an excess of oxygen at the anodes, which ensures a perfect oxidation and prevents the copper from precipitating any of the dissolved silver in a metallic form, while the metallic gold, which is not attacked, will fall to the bottom of the cells or tank and is collected. The anode solution, when saturated with copper and silver, may be replaced by fresh solution, or may be gradually drawn off at the bottom of the tank, while fresh solution is supplied at the upper part. In a separate tank, the silver is separated from copper by placing metallic copper in the solution, or precipitated as chloride by suitable reagents, and

metallic copper is separated from the sulphate by electrodeposition, leaving the free acid for use again. The arrangements may be varied. Instead of the said cells, dialysing vertical partitions may be cemented into grooves in the tank, so as to divide it into wide anode and narrow cathode cells or compartments. Again, the cathodes may be entirely covered with a dialysing protective covering, which prevents the metallic salts in solution from coming in contact with the cathodes but allows the electric current to pass, the water and acid of the solution soaking through the coverings. Sometimes the tank may have a false bottom of felt or other filtering material, to retain the gold or other undissolved metals or impurities in the bullion, and allow the saturated solution to pass through and be drawn out of the tank by a siphon or stop-cock. Also a metallic salt solution may be placed in the cathode cells to have the metal deposited on the cathodes, which may be electrotype moulds.

Besides the separation of metals, the invention may be employed in treating any solution capable of being changed in its nature or concentrated by electrolysis and dialysis combined, the material of the anodes and cathodes being changed to suit the solutions treated.

[*Drawing.*]

A.D. 1882, September 29.—No. 4636.

WEBSTER, James.—Bismuth bronze or alloy.

To produce a hard, tough, and sonorous bismuth bronze, suited to withstand the action of salt water, and fit for propeller blades, telegraph and music wires, &c., the inventor melts and combines about 1 part by weight of bismuth and 16 of tin to form a preliminary alloy, and then melts and combines about 69 parts of copper, 21 of spelter, 9 of nickel, and 1 of the preliminary alloy, this molten alloy or bismuth bronze being run into moulds for future use or sale.

To form a durable, bright and hard bronze for domestic utensils and other articles exposed to atmospheric influence, 1 of the 16 parts of tin used in making the preliminary alloy is preferably replaced by 1 part of aluminium.

[*No Drawings.*]

A D. 1882, October 5.—No. 4744.

BOND, JOSEPH, and WHITELEY, HENRY JOSHUA.—Converting cast iron into steel or steely iron.

The castings are placed in tubes or chambers within an oven or furnace, conveniently provided with openings and flues for distributing the flames and heated gases which pass around the outside of the tubes or chambers. After the latter have been sealed by covers, heat is applied to the oven ; its duration and amount varying with the size of the castings, construction of furnace, and arrangement of flues. The castings are thus converted into steel or steely iron, without using ore, ashes or other materials.

[*Drawing.*]

A.D. 1882, October 7.—No. 4789.

BOULT, ALFRED JULIUS.—(*A communication from Heinrich Josef Kolk, Carl Albert Julius Gursch, and Carl Heinrich Julius Klemm.*)—Type and other founding.

Type metal, purifying. Finely divided iron, in the form of bundles of iron wire, iron filings &c. preferably surrounded by, or mixed with wood charcoal is added to the molten metal, or is placed in the melting pot. The charcoal and iron may be made into a porous mass by heating with syrup and boracic acid or borax. By the action of this mass the sulphur, phosphorus, and other impurities in the molten metal, are removed. A portion of the iron becomes alloyed with the type metal and hardens it.

[*No Drawings.*]

A.D. 1882, October 11.—No. 4825.

KAGENBUSCH, JOHN PETER.—(*Provisional protection only.*)—Extracting precious and common metals, including gold, silver, and platinum, from siliceous, aluminous and other substances, and making aluminium, aluminium bronze, and other alloys.

The substances are pulverized, roasted with charcoal or any carbon (asphaltum), thrown red hot into preferably cold water, well stirred, and washed clean. The roasting may take place in vessels, crucibles, hearths, furnaces, or ovens ; gold quartz may

be heated to more than a red heat for an hour ; and tin, lead, copper, and zinc ores, &c., to only a red heat for two hours. The roasting is continued until sulphur pyrites or other substances, volatile without affecting the residues, are driven off. The washed substances are dried, and well mixed with fluxes for smelting, such as soda ash, carbonate of soda, potash or carbonate of potash, borax, lime, salt, rock salt and fluor spar, the silica and alumina chemically combined with the metals having to be brought into a soluble state. The mixture, after a few days' or preferably weeks' interval to allow of partial chemical combination taking place so that the mass will act less on the furnace, is heated to whiteness and melted in crucibles, furnaces, ovens, or hearths ; thus the greater part of the metals present will be chemically separated from the siliceous, aluminous, and other earthy injurious substances. Afterwards zinc and copper, by preference, are added to the melted mass, or another metallic combination producing electricity, and stirring takes place to cause the development of electricity ; which completes the said separation of the metals from the other substances. The metals are next separated mechanically from the dross or slag by washing out the soluble matters, and are then purified as usual.

Alumina, if present in the dross, may be reduced to aluminium by carbon, or there may be added metallic copper or substance containing copper or alloy of copper and, on again melting with stirring, the copper or substance containing it will combine with the metal aluminium in the alumina ; thereby producing aluminium bronze of better quality than heretofore, as it takes up all the gold, platinum, silver, and other precious metals left in the dross by the first process. The metal is mechanically separated from the dross and purified as usual.

[*No Drawings.*]

A.D. 1882, October 11.—No. 4833.

JOHNS, Thomas Henry.—Coating tin and terne plates.

A process is described by which sheets of metal are first coated electrolytically with tin, lead, or zinc, which coating may be finished by dipping the sheet into melted grease, or the sheet may afterwards be tinned and finished in the usual manner

The sheet coated electrolytically with tin, zinc, or lead, may be first passed through a bath of grease at a temperature below the melting point of the coating, and then tinned, or may be passed directly through a bath containing molten metal, grease, and flux, at a temperature lower than the melting point of the first coating. The bath is fitted with guides, between which the sheet passes to the finishing rollers. The amount of metal on the sheet is regulated by passing it between two adjustable parts which remove any surplus metal and allow it to pass to the next sheet. The sheet may then be passed through a grease bath to remove any surplus metal, and finished by passing between rollers, coated with metal, and running at a high speed in a grease bath.

[*Drawings.*]

A.D. 1882, October 11.—No. 4836.

TOUSSAINT, Joseph.—Construction of stacks or walls of cupola, blast, casting-pot, and like furnaces for the perfect distribution of the heat blast therein.

An annular or other chamber between the outer and the inner or lining walls is combined with openings in the lining wall at regular or irregular distances apart for the distribution of air or heat amongst the material under treatment in the furnace, Thus, streams of air from the tuyères and chamber may enter the furnace from above the basin up to about a foot below the top of the coke. The invention is applicable whether an artificial blast is used or not.

[*No Drawings.*]

A.D. 1882, October 14.—No. 4885.

BACHER, Gottfried.—(*Provisional protection only.*)—Extracting or removing sediments or precipitates during the sedimentary, precipitating, or clarifying process (especially in washing ores &c.).

A right-angled tank or receptacle, longer than broad, and with slanting side or end, has a movable or sliding false bottom, which passes through the tank and is led out of it and up its side in an inclined direction. The fluid containing the

sediment enters by a spout and flows along the tank towards the outlet, which it leaves in a clear state, having had time to deposit the sediment. The latter collects on the sliding bottom, and as this bottom carrying the sediment leaves one side of the tank, an empty false bottom enters at the other side, so that the bottom of the tank is always covered by a sliding bottom, whether the operation is carried out continuously or intermittently. As the sliding bottom has to move in varying directions, it must be flexible ; it can be constructed as an endless band, or as a band with ends with or without an edge. Its surface may be smooth, uneven, rough-milled, or provided with laths ; it may have cross-pieces, and be pervious to water or not. Round, polygonal, or other rollers will guide it. To form an endless band and continuous bottom, narrow boards, abutting one against another, may be fixed upon every two links of two angle-iron chains. The three principal curves of the band are effected by pairs of octagonal discs, round which the said chains turn, the space between the pair of discs remaining unoccupied. Small roller or disc guides for the chains are employed where the band begins to ascend the incline. The band is moved by a screw and a worm-wheel fixed on the same axle as a disc. The sediment carried out of the tank is removed from the sliding bottom, and the emptied bottom passes again into position to receive sediment. The sediment can be dried on the band by exposure to the air or in warm chambers.

Again, the receptacle may have two inclined ends, out of which in turn the sediment is conducted, and the movable bottom returns beneath the receptacle. Two rollers serve alternately as draft-rollers, the bottom working to-and-fro, and being wound alternately round the rollers. The sediment may be also removed in the absence of the fluid. By employing several superposed bands, sediments or precipitates of various degrees of fineness are obtainable.

[*No Drawings.*]

A.D. 1882, October 19.—No. 4982.

MADGE, Charles.—Gas furnaces for making zinc.

When air and gas are supplied to (and the outgoing gases

are conveyed from) the bottom of the regenerators by subjacent channels or culverts (running the whole length or breadth of same) and numerous slits or openings through the floor of the regenerators, the air and gas tend to take the shortest way to the stack, so that the furnace is not uniformly heated. To remedy this, the inventor divides each culvert or channel into two parts by a horizontal brick partition running the whole or part only of its length ; if the whole length, then one or more openings are provided in the same for the passage of air and gases. The stream of air or gas passing through each culvert being so divided, that portion which passes into or out through the upper half will supply or take from the end of the regenerator and furnace nearest to the entrance and exit end of the furnace, and the lower division will supply or take from the opposite ends and centre of the regenerators and furnace. The volume of air and gases passing into or out of the upper or lower half of the culverts can be regulated by partly closing the openings in the partitions or the entrances into the upper or lower divisions of the culverts, and so become uniformly distributed over the length or breadth of the furnace.

The air and gases are supplied to and taken from the furnace by vertical flues or channels, leading from the roof of the regenerators and opening horizontally into two parallel horizontal culverts or flues, which pass side by side under the bed from end to end of the furnace. These culverts are covered by bricks or brick arches, on which the retorts or muffles rest, or by the retorts or muffles themselves, openings being left through which the mixed air and gas enter or the gases pass out of the furnace ; one culvert is supplied with air and the other with gas, and the intervening partition prevents premature mixing and combustion. The slag, formed by the action of heat on the furnace and retorts and their contents, passes into and accumulates in these culverts, which thus become choked ; and the campaign or one continuous working of the furnace is thus terminated, the furnace having to be let out, cleaned, and repaired. To remedy this, the intervening partitions are provided with preferably 5 or 6 openings and there are corresponding openings on the outside walls of the furnace, all the openings being temporarily closed with bricks and luted with clay. When the slag has accumulated, these bricks are taken out, and only those in the outside walls are

replaced. The gas and air mixing and combustion taking place at a lower level in the culverts, sufficient heat is then produced to liquefy the slag, which flows into sand beds in spaces between the culverts and outside walls, the brick filling in the latter being removed at intervals to enable the slag to be withdrawn: thus the culverts are cleared of the slag. The slag, which sometimes lodges in the slits or openings between the bricks or brick arches covering the culverts, will be also cleared away.

[*Drawing.*]

A.D. 1882, October 21.—No. 5018.

HALL, Charles Edward. — Washing coal, coke, and the like.

The coal &c. is fed through a rotating perforated screen, or through a trough and feed worm, on to perforated jogging plates supported in a tank, which is enclosed in an outer tank, and communicates therewith. The screen may be divided into two parts having different sized perforations and the perforated plates correspondingly divided. A reciprocating pump and valve are provided, by means of which a constant circulation of water through the tank is maintained, and a pulsation through the plates. The washed coal is carried away from the plates by a rotating apron, and is delivered by a spout, or by a rotating perforated bucket-wheel. A dirt elevator may be combined with the washing-apparatus.

The creeper for carrying and straining the washed coal is formed of plain or perforated metal plates, of which the back edge is turned up. The creeper is carried on a chain of links upon circular sprocket-wheels. Illustrations are also given of jointed trough creepers driven on hexagonal drums, and of scraper creepers with attachable joints and links, of which the back bar or stirrup has a flat filed off its back face perpendicular to its length, the female joint being so turned over that the stirrup bar or male joint can only enter or issue when the one link is placed perpendicularly to the other.

In a modification of the washing-apparatus suitable for hand power, each of the tanks is made in two compartments arranged on either side of the crank, which rotates in a slotted link and operates two pistons.

[*Drawing.*]

A.D. 1882, October 21.—No. 5025.

PLAISTED, James, Lord Penzance.—(*Letters Patent void for want of final Specification.*)—Separating copper from mat or regulus containing also other metals.

The granulated or pulverized regulus is treated with concentrated sulphuric acid and submitted to heat, preferably with free access of air, as on pans or plates or in appropriate retorts. Sulphurous acid fumes escape, and free sulphur. The heat should be continued with constant stirring or other movement until the pulverized mass is completely dry. When cold, it is treated with water, when the copper salt formed in the process will dissolve and from this solution the copper may be precipitated by iron or be otherwise extracted.

All the copper is not generally extracted at once, and portions of regulus are not acted on. These should be treated again until all the copper is extracted. The process is facilitated by previously extracting iron, especially if present in large quantity, before treating for copper.

[*No Drawings.*]

A.D. 1882, October 27.—No. 5128.

DALTON, George.—(*A communication from Samuel Lowe Marsden.*)—Crushing stone, ores, &c.

The flat fixed jaw plate of a jaw crusher is to be replaced by a cylindrical jaw, preferably constructed in sections, otherwise of a single casting, and having either a smooth or corrugated crushing surface or a surface with projecting teeth or studs. The cylindrical jaw presents a broader crushing surface than a flat plate in a frame of given width ; and, when one face is worn, it may be turned to present a fresh face to the opposite jaw, and the relative positions of the sections may be changed to equalize their wear. Hence this jaw will endure much more wear than usual, while its adjustment in position is easier. The sections are preferably cast with a central bore and surrounding ring of holes. The bore contains a cross bar for moving the sections, and the holes may receive pins to hold the sections together. This jaw rests on lugs, inwardly projecting from the side framing ; and is held down by a key, lying across the top section, and passed through slotted plates and lugs of the side framing.

The swinging or movable jaw plate has a corrugated concave face, its curve corresponding to that of the cylindrical jaw, and being in its general outline equidistant therefrom in any line throughout its width. This jaw plate is adapted for fixing with either end uppermost; and may have its face bevelled off at one or both ends to enlarge the opening between the jaws there. It is held in place partly by studs projecting from the swinging jaw and entering inclined plate sockets, and partly by a screw bolt. The long horizontal arm of a toggle lever is connected to a crank shaft by a pitman. A renewable concave bearing is set in a corresponding socket, made in the back of the head of the lever, and is adjustable therein by set screws. The toggle block is made vertically adjustable by a screw, passing up through the framing and fitted with a nut; it has also a socket in its face, in which is adjustably held (by a set-screw) a fulcrum or bearing projecting into the concave bearing of the lever. The face of the lever has a socket, which adjustably holds (by a set-screw) a toggle bearing or fulcrum for one end of the toggle, and in the back of the swinging jaw there is a like connection with the other end of the toggle. Thus all of the lever and toggle fulcra or bearings may be adjusted, removed, and renewed as required, thus avoiding renewal of more expensive parts, and securing more accurate adjustability in the line of the greatest strain. A wedge, shown in a drawing as located between the toggle block and the framing, is vertically adjustable by a screw and nut to regulate the opening at the mouth of the machine and take up wear of the jaw faces; while the toggle block can give more or less motion to the machine by raising or lowering the centre of the fulcrum. The jaw is retracted after each forward movement by a rod, spring, and nuts. Adjustable or renewable fulcra or bearings are not claimed broadly.

[*Drawing.*]

A.D. 1882, October 31.—No. 5177.

MANGNALL, JOHN.—(*Provisional protection only.*)—Treating surfaces of metallic lead to prevent oxidation and corrosion.

Articles made of lead may be placed in a chamber and submitted to the action of superheated hydro-sulphuric acid gas, or they may be heated themselves in a furnace or stove and exposed to

this gas, the temperature being kept below the melting point of the metal. Thus the metal acquires a protective coating of insoluble sulphide.

Lead piping, as it issues in a heated state from the machine used in making it, may be internally acted on by connecting the gas generator to the piping.

[*No Drawings.*]

A.D. 1882, November 7.—No. 5316.

MEWBURN, JOHN CLAYTON.—(*A communication from Lazare Weiller.*)—Manufacture of silicious copper and bronze, and other compounds.

The prior Specification No. 1821, A.D. 1882, is referred to.

To produce a combination of tin with sodium, termed sodium-tin, 100 parts of tin are first melted in a crucible, and generally from 5 to 30 of sodium are very gradually added thereto with stirring. To make sodium-bronze, sodium-tin is added to melted copper, generally in such proportion as will give an amount of tin equal to from about 0·10 to 15 per cent. of the copper. These compounds may be used in making silicious bronze and for other purposes.

To produce silicious bronze, sodium-tin or sodium-bronze may be sometimes substituted for the materials used in accordance with the prior invention, to produce the sodium necessary during the operation. Or, instead of forming these compounds previously, tin and sodium, with the desired amount of fluo-silicate of potass may be introduced into the melted copper or bronze. To produce silicious copper, sodium is introduced with the said fluo-silicate into the melted copper, and silicious bronze may be likewise produced by using melted bronze containing sufficient tin. The fluo-silicate should be added first, then the sodium, and lastly the tin, if any. Again sodium and sodium-tin or sodium-bronze may be used together. From about 2½ to 4 times as much fluo-silicate of potass as sodium should be used. The materials added react in the midst of the mass during the fusion of the alloy. The proportion of tin, for silicious bronze, may vary from about 0·10 to 15 per cent. of the copper, and that of silicium, for silicious copper and bronze, from about 0·05 to 12 per cent. of the alloy.

The new process of producing the silicious alloys allows of

making wire for conducting electricity and other purposes, and also machinery and guns offering great resistance to molecular disturbance.

[*No Drawings.*]

A.D. 1882, November 9.—No. 5344.

HACKNEY, William, and WAILES, John William.—Regenerative gas furnaces.

Especially in furnaces, to which the prior Specification, No. 4097, A.D. 1878, relates, the combustion or working chamber is to be built independently of and unconnected with the regenerator chambers, which communicate with it through comparatively light and portable pipes or flues, formed of plate or sheet iron, cast iron, or other material, and lined with some fire-resisting and badly-conducting substance. Thus the ends of the pipes may be lined with firebricks, and the intermediate portions be protected from heat by loam rammed in round a core. The brick lining at the said ends should project beyond the casing so that this may not be exposed to the heat. Dry sand will check leakage at some joints ; and those between the gas pipes and the ends of the combustion-chamber are rammed with clay between the ends of the pipes and cast-iron flanges fixed to the wall of the chamber. The air pipes may be directly behind the gas pipes or set alternately with them, or otherwise arranged. The drawing shows the gas-inlet ports as placed in the end walls of the combustion-chamber, and the air-inlet ports in the roof at each end. The pipes may be more or less numerous than the corresponding ports. The gas pipes may be held up against the ends of the chamber, and the gas and air pipes may be kept upright and held together, if needful, by tie-rods or otherwise.

Such furnaces are more cheaply built and readily repaired. In steel-melting furnaces the whole melting chamber may be built of basic bricks, and the basic work may end in the gas and air pipes, the lining of which is so thin that its rapid melting will be prevented by the cooling action of the external air. Thus, the difficulty from the melting of the junctions between the basic and silicious portions of furnaces for the basic steel-making process is avoided.

[*Drawing.*]

A.D. 1882, November 10.—No. 5367.

GRAHAM, James Anthony.—Coating iron or steel with lead.

The surface of the article to be coated is cleaned, and the article placed in a heating-chamber. A strong solution of chloride of zinc is floated over the surface, and the article heated to a temperature slightly higher than that of melted lead. Molten lead is poured over the surface, the temperature being maintained until the chlorides cease to rise; the lead may be agitated to hasten the operation. The chlorides are then washed off and the coated metal may be rolled or otherwise treated to give a uniform and homogeneous surface to the lead.

In a modification of the process, solid chloride of zinc may be fused on the surface to be coated, and the lead then applied in a solid form.

[*No Drawings.*]

A.D. 1882, November 11.—No. 5384.

CLARK, Alexander Melville.—(*A communication from Ferdinand Eugene Canda*).—Bearings.

Amalgam or alloy for bearings. Any metal or alloy in use for bearings that will form an amalgam with mercury, is crushed to a powder; to the powdered metal or mixture, is added an equal weight of mercury, and, if required, 5 to 10 parts by weight of pulverized graphite, or other lubricating material. These materials are thoroughly mixed together to form an amalgam, the operation being hastened by heat when desired.

[*No Drawings.*]

A.D. 1882, November 11.—No. 5390.

LAKE, William Robert.—(*A communication from Léon Louis Charles Krafft and John Edward Schischkar.*)—Treating ores &c. containing copper and zinc.

Oxides and carbonates of copper and zinc may be dissolved by aqueous solutions of ammoniacal gas or of carbonate of ammonia, to be afterwards precipitated by expelling the ammoniacal gas or carbonate of ammonia from the solution. Ores, not naturally containing oxides or carbonates of copper

and zinc, must be roasted completely several times with carbon to decompose the sulphates, antimoniates, arseniates, &c. For each part by weight of the metal in the ore, 10 parts of commercial liquid ammonia are employed. The arrangement of apparatus varies ; the ammoniacal gas being driven from its solution containing the metal sometimes by the action of heat alone, and sometimes by that of a vacuum with a little heat.

The pulverized ore may be charged through a hopper into a sheet-metal cylindrical mixing vessel, and the liquid ammonia is then introduced. The vessel contains a half helix or screw blade, actuated by bevel gearing, to constantly agitate the mixture, the operation being effected at the ambient temperature. After the dissolution of the oxide or carbonate, the agitator is stopped and settling takes place. The ammoniacal solution is then successively drawn off at three different levels into a tank. This solution is cloudy and (when the oxide of zinc is to be used for making colours) should be forced by a pump through a pressure filter of asbestos or wool, compressed between two perforated plates and easily replaceable. The sandy residue or gangue in the mixing vessel still retains ammonia containing metal in solution ; more ammonia is introduced, agitation takes place, then settling, and the liquid is drawn off into the tank. The gangue now only retains nearly pure ammonia ; it passes with water, admitted to the vessel, into a boiler ; wherein the ammonia is extracted by energetic exhaustion caused by a powerful pump, while steam is introduced. The exhausted ammonia is driven into chambers for regenerating the ammoniacal liquid.

Again, the ore may be treated in a sheet-metal cylinder, having semi-spherical ends and revolving upon hollow axles, one of which receives driving pulleys, and the other a pipe passing through a stuffing-box and connected to pipes for supplying water, ammonia, and compressed air. Towards the middle of the cylindrical wall a filter, enclosed between two sheets of metal, is closed by a tight cover. After rotating the apparatus containing the ore and liquid ammonia, it is stopped with the filter downwards, compressed air is admitted, and the filtered solution passes through a flexible tube into a still or alembic. Instead of using pressure, suction might be employed by previously creating a vacuum in the still. Afterwards the residue in the cylinder is washed twice with ammonia and then

once or twice with water, filtering as before, so as not to leave any metal in the residue, which is subsequently washed out by a strong current of water.

To extract by means of a vacuum the ammoniacal gas from the solution and so precipitate the dissolved oxides or carbonates, the liquor is delivered by a rotary pump into a strong sheet-iron evaporator, containing a helical agitator and a serpentine-heating coil for steam; which maintains a temperature of about from 25° to 30° Cent. By an exhaust pump the proportion of the ammonia in the liquid can be reduced to one-tenth, when the liquor will contain only traces of zinc and will serve to regenerate the concentrated ammoniacal liquid. The metallic oxide, precipitated during the operation, accumulates at the bottom of the apparatus, and the liquid is drawn off at different levels into another tank. Then the agitator is set in motion, pure water is admitted if needful, and the oxide or carbonate passes in suspension in water to a filter with a perforated metal-plate bottom, covered with wool or felt, whereon the matters collect, to be dried and calcined.

The ammoniacal solution in the still may be heated by an open fire or otherwise until nearly the whole of the ammonia escapes by a serpentine coil (and passes with the condensed water into regenerating apparatus); the precipitation of the oxides or carbonates being thereby effected. Afterwards an agitator at the bottom of the still is set in motion and the deposit flows with the hot water into a filter like that above described; whence the still slightly ammoniacal liquid passes to the regenerating apparatus through a refrigerator, having compartments for a circulation of cold water.

Complex ores may be treated by this process to utilize the copper and zinc only, or to isolate them from other metals which must be extracted separately: thus, in treating calamine containing lead, carbonate of lead is found in the residue unattacked and a single washing frees it from gangue. Also other materials, as refuse copper or zinc in cuttings or filings, and cupreous or zinciferous solutions may be treated.

The apparatus, which is subject to modification, is provided with inlet and outlet cocks, taps, and valves, water gauges, connecting pipes, and manholes for charging and discharging or cleaning out.

[*Drawings.*]

A.D. 1882, November 13.—No. 5399.

HUNTINGTON, Alfred Kirby.—Alloys.

To secure strength, elasticity, and closeness of grain in making alloys of the kinds of bronze, brass, gun-metal, and the like, consisting chiefly of copper with tin, zinc, or other white metals ; the inventor adds to the copper or alloy a little silicious iron, which may contain a small proportion of metals like manganese or tungsten. The mixture is made while the materials are molten and as nearly as possible at the same temperature. Not more than 2 per cent. of silicious iron may be added in the case of ordinary gun metal, nor more than 5 in that of brass. When tin is present besides copper and zinc, less silicious iron is used than without tin. When zinc is present, silicious iron containing manganese is preferred.

[*No Drawings.*]

A.D. 1882, November 13.—No. 5411.

FELTON, William.—Furnaces.

Reheating, smelting, puddling, and other reverberatory furnaces may be constructed, as shown in drawings, with a gas producer forming part of the furnace itself. The lower part of the producer has a blast box provided with an inlet nozzle, by which steam and air are admitted to the box and thence pass by openings into the producer ; a steam jet drawing air with it into the nozzle. An arched wall is shown as separating the upper portion of the producer into two parts, each of which has a covering-slab at the top. The wall will support the hopper when the stoking is done from the top, or there may be a charging door elsewhere. Upper and lower doors are shown for clinkering and removing ashes, and with holes for inserting a tool. Just below the upper clinkering door, there is an opening in a frame for introducing bars to rest on the frame and opposite wall and so support the fuel above, while the ashes beneath are removed ; the steam being turned off during this operation, and the said opening being at other times closed by a stopper. As the gas produced passes through openings and over the bridge, it is met by heated air issuing through openings in the top of the bridge and complete combustion takes place in the furnace itself. The said air becomes heated in a flue in the bridge, to which it may be led through a passage under the sole

or at the side of the furnace, or the said flue may itself open at the side, a damper regulating the admission of air. To stop the generation of gas and the combustion at any time, the steam is turned off and the said nozzle closed by a cover, and the damper is also closed.

The blast box may be placed at a lower level and discharge beneath permanently fixed bars in the lower part of the producer.

[*Drawing.*]

A.D. 1882, November 16.—No. 5454.

NICHOLAS, James.—Pulverizing sand, ores, metals, &c.

The machine employed comprises a barrel or rubber, which is made of inclined planes, cast or bent into a cylindrical form, and so placed that the larger end of each plane is next to the lesser end of the following plane. The barrel is generally pierced with slots or holes, varying in number and position according to the material for treatment. It revolves within an outer case or cylinder, which is generally fitted at its lower part with a removable plate or false bottom partly surrounding the barrel, and likewise pierced with holes (except sometimes when hard and gritty material is treated). At the ends of the cylinder there are brackets to receive and keep in place slides; in and on which rests an axle, the latter projecting through both ends of the cylinder and driving the barrel. The slides have a lever and weights or springs, to raise or depress them and the barrel, whereby to bring the barrel and the false bottom to such a distance from one another as desired, and to take the surplus weight of the barrel from the driving power, and to reduce the friction between it and the bottom. The material for treatment, reduced to a small size and placed in a hopper, is conducted by means of water through a side aperture in the cylinder and falls on the barrel, which in its revolution will rub or crush it on and against the bottom (or false bottom), the action being that of a series of grindings or pressures: and as each inclined plane comes into contact with the bottom, the material will be ground or pulverized. The groove, at the junction of the greater and lesser ends of the inclined planes, allows a space for the material to change position so as to receive pressure on another surface. When

sufficiently ground, the material will be carried out of the apparatus by the escape of water through an opening in the opposite side of the cylinder.

[*Drawing.*]

A.D. 1882, November 20.—No. 5509.

GROTH, Lorentz Albert.—(*A communication from Richard Gratzer.*)—Production of magnesium, aluminium, and other metals of the alkaline earths.

The chloride or fluoride of the metal required is melted and electrolytically decomposed in a crucible or melting vessel or chamber, which may be made of metal (such as iron for magnesium, copper or iron for aluminium, and so forth), and which being connected to the negative pole of a dynamo-electric machine serves as the negative electrode. Melting-vessels made of graphite, fireclay, or porcelain, may have suitably-shaped metallic projections for negative electrodes. The vessel has a cover, through which the positive carbon electrode is introduced. The invention includes the simultaneous employment and conduction of reducing-gases, which can be best introduced and conducted through the closing lid from above ; or the gas may be introduced at the side of the vessel if preferred.

[*No Drawings.*]

A.D. 1882, November 25.—No. 5607.

WELDON, Walter.—Wet extraction of copper.

Instead of producing copper precipitate by precipitation with metallic iron, the inventor adds to the copper extractors' mixed solution of chloride of copper and sulphate of soda (preferably after it has been treated to separate silver and gold) sufficient calcium chloride to decompose the sulphate of soda, thus obtaining a precipitate of calcium sulphate, and a mixed solution of chloride of copper and chloride of sodium This precipitate is separated from the solution and washed ; and the copper in solution is then precipitated as oxide by treating the filtrate and the wash-waters with lime (as milk or otherwise) with or without magnesia ; or magnesia might be used instead of lime. Thus the oxide of copper may be more

cheaply precipitated than, and would be as available for use as, the copper precipitate.

[*No Drawings.*]

A.D. 1882, November 28.—No. 5648.

ROBERTS, Henry.—Annealing and pickling wire, feeding wire to a zinc coating bath, and wiping off the surplus zinc.

The annealing pots are annular, and have flanges extending round the outer edge, and lugs on the inner part, supporting radial plates being provided extending between the two parts. The pots contain sand and are lowered into a chamber (the lower end of which is surrounded by sand) by a special lifting-apparatus adapted to hold simultaneously the flange on the outer part and the lugs on the inner part. By this means distortion of the pot while in a heated and softened condition is avoided.

For pickling the wire a special reel or stand is provided for lowering the coils of wire into the acid. A cylindrical reel is used, adapted to stand on end, and having at the lower part radial holes bushed with copper. Pins fit into these holes and project outwards. The coils are put on and rest on the pins. The upper end of the reel has a bail or cross-bar by which it can be lifted. A suitable stand is described for taking the weight off the pins when desired to remove them.

The wire is coated with zinc by the use of a number of vertical reels carrying the wire, arranged in a special manner on one side of the bath. The wires are drawn through the bath by separate rolls, each of which is driven by a clutch so that it can be released if any entanglement occurs. A method of feeding on the wires from the reels is described, adapted to detect entanglements and allow time for coupling the ends of the wires. For wiping off the superfluous zinc &c. the wires on the way to the rolls are made to pass in a slanting direction through a box, the lower edge of which overhangs the bath. In the box are a number of transverse rolls provided with projections, and a quantity of wiping material, preferably slagwool. The rolls act so as to work the slagwool against the wire, and wipe it thoroughly. A number of suitable rams may be arranged to work in the box and feed the wool to the rollers.

[*Drawings.*]

A.D. 1882, November 28.—No. 5649.

ROBERTS, HENRY.—Manufacture of zinc-coated wire.

For pickling or annealing purposes, wire is placed in coils round a hollow cylinder standing on end, and flanged internally at the lower end, where it is provided with removable pins on which the lowest coil rests. In the interior, the cylinder has a loose curved bail or handle, with which a hook can engage for lifting. The handle may also be fixed and buried in the cylinder. In annealing, the flames have access to the interior as well as the exterior.

For pickling and cleaning the surface of wire before galvanizing, it is drawn through a tank containing acid and broken stones or cinder. The wire after this operation is heated in a furnace before passing into the metal bath. Guides in the bath are adjustable vertically, and fixed at the same level by lugs engaging with a cross-bar above the bath. The wiping is effected by slag wool contained in an apparatus of the form described in Specification No. 5648, A.D. 1882, or by a die arrangement formed by a fixed piece combined with three movable pieces, enclosing a conical space through which the wire passes. The pieces are held together by the action of adjustable weights, or by springs or other means. To spread the ridges formed by the openings between the pieces, the wire is passed through a separate wiping box containing slag wool.

[*Drawing.*]

A.D. 1882, December 1.—No. 5723.

STURTEVANT, THOMAS LEGGETT.—Attrition mills.

Ores may be treated. A circular head or disc, recessed or chambered in front, is secured at rear to one end of a horizontal rotary shaft mounted in standards. One edge of the head revolves close to the rear side of an upright flat housing or standard ; which has a circular opening opposite the head and equal in diameter to its outer circumference. An adjustable and renewable tubular lining or outer reinforce of hard material to resist abrasion, like chilled cast-iron, is bolted or otherwise fixed to the head, fitting its bore or periphery ; and extends into and closely fills the said opening. Between the said housing and a parallel housing, a circular ring plate is kept in position by antifriction rolls, pivoted between the

housings, and bearing on the circumference of the ring plate. The latter is rotated (preferably in an opposite direction to the head) by an annular toothed rack on its circumference in gear with a pinion on another horizontal shaft, which may receive motion from the first-mentioned shaft. The upper part of each housing has an opening, one opening being the filling mouth of the mill ; while the other forms an outlet for the powder produced in the mill, and is connected to a suction fan or other means for removing the powder. The inner periphery of the ring plate contains cells, depressions, or enclosures, which constantly operate to elevate the powder to the outlet. The material for treatment is supplied to the interior of the receiver, bounded by the ring plate and the housings. Part of the material fills the chamber of the said head and, rotating with it, provides a moving grinding surface, while the remainder in the receiver tumbles about under the action of the rotary ring plate, so that between the two forces the material is continually being reduced to powder (by attrition between its particles).

Again, the removal of the powdered material (so as to prevent clogging of the unground portion) may be effected by an endless band, carrying buckets to enter in succession peripheral openings in the ring plate and to receive and elevate the powder, which may be conveyed to a screen so arranged with respect to the filling opening that the coarse particles in the powder are returned to the receiver. Also a rotary stirrer or central shaft with radial arms may agitate the unground material in the receiver.

[*Drawing.*]

A.D. 1882, December 1.—No. 5734.

DICK, George Alexander.—Alloys.

To brass containing from 30 to 55 per cent. of zinc and from 70 to 45 of copper (or to either the zinc or copper before they are mixed) there may be added sufficient manganese-copper to allow of the improved alloy containing from 0·05 to 5 per cent of manganese. This makes the alloy harder, stronger, and tougher, and improves its colour : but the manganese rapidly oxidizes in remelting. To prevent this, phosphorus in the form of phosphuret of copper may replace part of the manganese

The phosphorus makes the alloy stronger and harder ; but, as it lessens its malleability and renders it unfit for forging when hot, it must be used in minute proportions. About 0·1 per cent. of phosphorus may replace about 1 per cent. of manganese ; but the proportion of phosphorus must not exceed one-half the amount of manganese in the manganese-copper employed. The copper added, as manganese-copper and phosphuret of copper, is reckoned as forming part of the above-stated proportions of copper.

[*No Drawings.*]

A.D. 1882, December 4.—No 5764.

BRENTNALL, John Cresswell.—Furnaces.

Furnaces and mechanical stokers for steam boilers etc. are described ; but part of the invention, hereinafter referred to, specially relates to puddling-furnaces.

The fuel descends from a hopper into a box, where it is crushed between a rotating toothed roller or set of toothed wheels and curved toothed bars. The box contains a horizontal shaft with eccentrics for each of the bars, which are placed side by side, each eccentric giving up-and-down and to-and-fro movements to the upper end of one bar. The lower ends of the bars slide against a fixed or adjustable rod or an eccentric shaft, so that the ends can be brought nearer to or farther from the toothed roller. The fuel descends from the box into a combustion chamber, and falls upon the furnace bars near their outer ends. Each of these bars is formed of a lower or bearing bar and an upper bar, preferably made in short lengths or sections. The lower bar comprises two side bars connected by short cross-bars, upon which are hooked the sections of the upper bar. There is a space for air between the upper and lower bars, the former only resting upon the latter at intervals. These compound bars slide upon a stationary cross bearer at the inner ends ; and, by means of a separate set of three eccentrics or cams at the outer end, each bar receives end and lifting movements, which propel the fuel along the bars from the combustion chamber at such speed that, when it reaches the inner ends, its combustible part is exhausted and the ashes drop down. In passing from the combustion chamber the fuel goes under a

bridge or archway ; the space beneath which regulates the thickness of the fuel on the bars within the furnace, where the fuel has become incandescent. Provision is made for admitting air to the combustion chamber and for supplying fuel by hand-stoking.

In furnaces for puddling iron or like purposes, where fuel has to be supplied at times to generate gas for preventing oxidation of the metal, the inventor arranges a separate hopper, or forms a shoot from the hopper feeding to the combustion chamber ; so that, by drawing a damper, fuel may be supplied to the furnace beyond the bridge or arch, and fall upon the incandescent fuel on the bars and generate gases.

[*Drawings.*]

A.D. 1882, December 6.—No. 5827.

ROLLASON, Carmi Alexander Thomas, and ROLLASON, Charles Arthur.—(*Provisional protection only.*)—Cleaning metals.

Iron for wire drawing, galvanizing, tinning, etc. is cleaned by heating it almost to a red heat and immersing it in a strong solution of hot salt and water.

[*No Drawings.*]

A.D. 1882, December 8.—No. 5854.

KEEP, William.—Alloys.

A non-corrosive alloy of increased whiteness and uniformity in colour (dispensing with the need of a coating, and more easily worked than German silver etc.) may be composed approximately of from 66 to 70 p. c. of copper, from 9·8 to 20·0 of nickel, from 0·1 to 0·5 of tin, from 0·1 to 5·0 of cadmium, and from 8·5 to 20·0 of zinc. To render the nickel more fusible and avoid loss by volatilization of other constituents, copper is first melted, and an equal quantity of nickel at a red heat is added to it. When completely melted, the alloy produced is poured into ingots, and the percentage of each metal present may be determined by analysis. Then the alloy is again fused and more copper is added to obtain the relative proportions of copper and nickel required ; after which the tin, cadmium, and zinc are added in turn.

Again, the alloy may comprise from 60 to 65 p. c. of copper, from 20 to 25 of manganese, 0·5 of tin, from 0·5 to 5·0 of cadmium, and from 9·5 to 14·0 of zinc. In this case ferro manganese (containing as little iron as possible) replaces nickel in the first melting operation, and the resulting melted alloy, on removal from the fire, is thoroughly skimmed on the surface to remove the iron as much as possible. After cooling, this alloy can be remelted, and the skimming repeated to remove any iron still present. The required alloy is afterwards made as above described.

In the melting operations charcoal, borax, or other material is used as a covering to prevent oxidation, and stirring is employed. A flux, preferably red tartar, is used for introducing the cadmium.

[*No Drawings.*]

A.D. 1882, December 8.—No. 5856.

PORTER, George.—(*Provisional protection only.*)—Diaphragms for gas governors &c.

An alloy, suitable for making the very thin diaphragms used for working the valves in gas governors and for other apparatus, consists of eighty parts of tin, fifteen of lead, and five of bismuth.

[*No Drawings.*]

A.D. 1882, December 15.—No. 5998.

LOIZEAU, Léon Louis.—Breaking, grinding, or pulverizing stones, ores, etc.

The ends of a metal case, which is bolted to a frame, receive bearings for a rotating shaft carrying a sleeve with cheeks or washers, whereon are pivoted levers. The outer ends of the levers carry steel or other hard metal rollers, which are free to rotate on their axes. The material for treatment is charged into the case at the sides or top. By the rotation of the sleeve the rollers are drawn into a circular movement against the inside of the surrounding case, and crush the material, which is thrown by the rotating levers against the case. The fineness of reduction is determined by the outlet for the reduced material. The outlet

may be at one or both sides; or, if the material is required in an impalpable state, the outlet should be at the upper part of the casing.

[*Drawing.*]

A.D. 1882, December 16.—No. 6013.

PATTERSON, JOHN.—(*Partly a communication from Frederick Morris.*)—(*Provisional protection only.*)—Amalgamating and settling apparatus.

Pulp or even tailings may be treated to recover precious metals. Upon sleepers or supports are placed the bottom planks of a preferably wooden circular tank or vessel; upon the said planks rest the internal bottom planks, which support a series of flat fan-shaped wooden dies with the grain vertical. Wooden strips of less depth, placed between the dies, form a series of radial channels, and a like strip intervenes between the dies and the sides of the vessel. At the inner ends the dies are kept from contact with the pillar by wedges. The central pillar rises nearly to the top of the tank; and vertical outflow pipes pass through it and out at the bottom of the tank. It is of advantage to draw off the water at the neutral centre where it is comparatively still. The pillar has a metal footstep; wherein can revolve a shaft carrying preferably four radial arms, through the outer end of which a series of elongated bolts or tie-rods pass vertically. The lower ends of the rods carry weighted wooden shoes with the grain vertical. The shoes cover radially slightly more than half the dies, whereon they rest; and are alternately arranged to pass over the outer and inner horizontal faces of the dies, as the shaft and arms revolve. The strain on the vertical rods is partly borne by tie rods passing from one shoe to the preceding arm. The said shaft passes through a T-shaped bearing, fixed to the top cross beam of the vessel; and ends in an inverted bevel-wheel, in gear with a subjacent wheel fixed to a horizontal driving-shaft, the end of which rests in the shank of the T bearing, while its outer extremity is suitably supported and has pulleys for a driving belt. The cross beam is supported in sockets bolted to uprights secured to sides of vessel, and is held in place by taper pins or bolts. Thus the vertical shaft with its gearing may be removed without other interference; while, after removing the taper pins, the cross beam and the

balance of the gearing may be removed leaving the vessel quite open at the top for removing the radial arms etc.; or the entire gearing and radial arms with their connections may be removed without disconnecting the arms from the shaft, rapid cleansing or repairing being attainable. After the ordinary process of amalgamating and settling, the water is gradually drawn off by taps at different heights on the sides of the vessel.

[*No Drawings.*]

A.D. 1882, December 19.—No. 6056.

PLAISTED, JAMES, LORD PENZANCE.—(*Provisional protection only.*)—Extracting gold from auriferous pyrites.

Generally after being calcined, the ore is smelted with a suitable flux in a cupola or smelting furnace, a cold blast being generally suitable. The resulting regulus or matt, containing the iron and gold, and perhaps other metals, after being crushed or ground, is treated with dilute sulphuric acid, agitation and heating to the boiling point expediting the ensuing action. Sulphuretted hydrogen gas is evolved, and provision is made for its disposal. A solution of sulphate of iron is obtained and utilized; and the insoluble residue which will contain the gold and some other metals and perhaps silica, is collected, washed, and dried. If metals other than gold or silver be present in quantity, they might be separated from the residue by known means, before it is melted with lead or material yielding lead in a reverberatory or other furnace or cupola. From the resulting lead, the gold and any silver present in the ore may be extracted by cupellation, and they can be separated from one another in the ordinary way.

Any regulus, not acted on by the acid after boiling for an hour or two, should be re-smelted. Other acids or reagents, especially hydrochloric acid, might be used for treating the regulus.

[*No Drawings.*]

A.D. 1882, December 19.—No. 6058.

FAURE, CAMILLE ALPHONSE.—Obtaining metals.

Hitherto the production of sodium and of the cyanides by fixing atmospheric nitrogen has been performed in externally

heated apparatus, containing the alkaline composition and the carbon or other composition. The inventor raises the material to a moderate temperature by external heating, and attains the high temperature required by applying the heat of electric arcs, currents, or discharges directly to the alkaline matter.

The description and drawing indicate a furnace with a metal casing, supporting the structure and containing a very refractory block or lump, within which is a cavity having at its bottom a drum-like grating to turn on its axis and discharge the residual carbonaceous matters. The materials for treatment are placed in a covered tube forming an upward continuation of the cavity, and surrounded by a flue or jacket, through which the heat from an adjacent firegrate passes. A lateral passage leads the vapours produced during the reaction from the cavity to external condensers. Carbon, iron, or other pencils or electrodes are adjusted in radial openings through the said block to slide longitudinally as the resistance to the electric current demands. Their movement is generally automatic and is regulated by the current itself; electromagnet bobbins, being traversed by a small part of the current, permit a movement co-ordinated therewith. The materials already heated in the tube, on reaching the cavity come under the influence of an additional very high temperature. The passage of the vapours produced to the condensers may be aided by introducing at the bottom and top a gentle current of gas (oxide of carbon or hydrocarbon gas, in treating alkaline matter to obtain the alkaline metal). The heating tube is sometimes dispensed with. The claims extend to the reduction or manufacture of "the alkaline metals."

[*Drawings.*]

A.D. 1882, December 19.—No. 6064.

CHENHALL, JAMES WARNE.—(*Provisional protection only.*)—Calcining regulus or matte.

Regulus, especially copper regulus and regulus containing gold and silver, is ground and mixed in a mill with enough moist clay to make a plastic mass, which is formed into pellets or balls and dried. The latter are then burnt in kilns, like pyrites burners connected to sulphuric-acid chambers. When once lighted, combustion proceeds without using carbonaceous fuel, and no difficulty arises from fluxing or agglomeration.

The product withdrawn from the kilns is well suited for the next operation, and the sulphurous acid produced is in a suitable state for forming sulphuric acid by the ordinary chamber process.

[*No Drawings.*]

A.D. 1882, December 20.—No. 6076.

GROTH, Lorentz Albert.—(*A communication from the Campbell Mining and Reducing Company.*)—(*Provisional protection only.*)—Treating gold and silver ores.

If a little sulphur and base metals be present, the ores are pulverized and then roasted in a desulphurizing furnace. They are passed once or twice through an oxidizing fire, being first thrown upwards by an injector, so that the lighter particles pass off at the top of the shaft of the furnace: while the heavier drop and pass a second time through the flame to be deposited in the pit. The lighter ore particles are led through a tube to a series of settling chambers, having intermediate vertical connecting tubes, which are provided with water spray apparatus, the finest particles finally passing through a channel with an exhaust apparatus, and being collected in a water tank. The oxidizing flame is obtained from an injector, fed with hydrocarbon and with steam.

The ores thus treated are conveyed into a vessel containing molten lead, through a neck extending at one side, by means of a reciprocating piston, whereby the charge of pulverized ore is fully immersed into the lead, kept molten in the vessel by a furnace below it. Thus the minutely-divided charge has to pass through the body of the lead to its surface: whereon it floats and is then taken up by shovels and passed into an adjacent smelting furnace. The bath of molten lead is not used for amalgamating the metals, but for mixing the ore with the lead to prepare the ore for more rapid and successful smelting. The lower part of the smelting furnace has tuyères with a slag hole just below it. The lead, which has absorbed the precious metals during the smelting process, is run off through a discharge hole and returned to the lead bath to be again mixed with ore. This operation is continued until the lead is well charged with precious metals, which are afterwards separated from it by cupellation.

Ores, not requiring to be roasted, are pulverized and passed directly to the lead bath.

As much of the precious metals present as possible may be obtained from refractory ores, by the repeated mixing of the ore with molten lead and then subjecting the ore charged with lead to the smelting operation, and so on.

[*No Drawings.*]

A.D. 1882, December 27.—No. 6169.

EDWARDS, HENRY, and HARRIES, HENRY.—Silica fire-bricks, fire-cement, and fire-ware goods generally.

The small percentage of lime usually added to the ground silica is to be partly or wholly replaced by Portland cement; and the bricks or articles to be produced can be moulded straight from the mill without "maturing" or "tempering" the mixture employed. When moulded, they will quickly set and dry with or without heat, and are baked in a kiln. The cost of manufacture is lessened.

Calcined flints, Dinas stone, millstone grit, ganister sandstone or sands may, when needful, be ground wet or dry; for instance, by edge runners and using lime water or clear water, preferably hot, to moisten the material for moulding, the Portland cement being intermixed during the last few turns of the mill. Fire-cement is made by mixing the Portland cement and silica in a dry state, and is used like mortar to set the bricks or other moulded articles in furnaces, and as furnace lining and luting and for repairing furnaces.

The proportion of Portland cement will vary according to the heat to be resisted, and will be larger when lime is not used. For bricks to resist great heat 1 per cent. of lime and 2½ of Portland cement may be added to the siliceous material.

[*No Drawings.*]

A.D. 1882, December 30.—No. 6229.

DYER, HENRY CLEMENT SWINNERTON. — (*Provisional protection only.*) — Removing impure portions of ingots of malleable metals.

As sulphur, phosphorus, carbon, silicon, or like impurities tend to collect in the part of the metal which solidifies last, *i.e.* "in the vertical axis about one third of the length of the ingot

"from the top," and give rise to weak or impure parts as in plates rolled from the ingot, whence even gold and silver coins cut from such parts are wanting in purity, the inventor places a hollow die (the hole in which is about the size of the part of the ingot desired to be removed) on the top of the ingot, which rests upon an anvil; and the die may be fastened to the ram of an hydraulic or other press. On applying pressure, as the inside of the ingot is softer than the outside, it will the more readily flow in the line of least resistance; thus the objectionable parts are forced up the hollow die, and can be removed at once or used for holding the ingot (which is shortened by this operation) during subsequent forging. A pointed or conical plunger may be first forced into the centre of the head of the ingot (which may have become solidified) to tap, as it were, into the still liquid or semi-liquid part within. The ingot may be placed for treatment in a strong mould box to keep it symmetrical and consolidate the metal as in forging.

[*No Drawings.*]

1883.

A.D. 1883, January 1.—No. 8.

HOWDEN, James.—Furnaces for heating, melting, &c.

The furnace front and ashpit are protected by a casing through which the air is supplied by natural or forced draught.

In one arrangement, the air, after being heated by a regenerative arrangement, passes by a flue to a forked flue which supplies it to each side of the air casing. Two rising side flues,

united by a cross flue at the top, distribute this air to three other compartments into which the casing is divided. The air supplied to the first of these compartments is regulated by a valve, and passes partly through perforations in the inner furnace door, and partly through apertures leading into perforated tubes placed one at each side of the furnace. Opposite the furnace door is an outer furnace door. From the second compartment the air supply, controlled by a valve, passes through the hollow firebars to a recess in the firebridge, and thence to the furnace through inclined orifices. The third compartment communicates with the ashpit, and has also an outer door and an air-regulating valve.

In a modification, the casing is applied to the end and side of a furnace, the furnace door being at the side. In another modification, the fire space has a solid hearth, the orifices already mentioned in the firebridge, side tubes, and the furnace door supplying the air for combustion.

In puddling and similar iron bound furnaces the casing may be made part of the tier for binding.

[*Drawing.*]

A.D. 1883, January 1.—No. 9.

SWAIN, JOSIAH.—(*Provisional protection only.*)—Smelting and melting furnaces for ores and metals.

The gases from the furnace are led to a chamber containing superheated steam, mixed with which they return to the furnace. The steam may be heated by being passed through pipes in the flue or by other means. Induced currents of cold or heated air, or the ordinary air blast, may be employed as well. When the cupola is provided with a receiver some of the gases are led through the latter on their way to the steam chamber.

[*No Drawings.*]

A.D. 1883, January 2.—No. 30.

WILLIAMS, JOSEPH.—Refractory or fire bricks, tiles, blocks, pipes, tuyères, etc.

Relates to the manufacture of refractory bricks, tiles, blocks, pipes, tuyères, and other like articles, and to a cement for the same. Ground quartz, gannister, or other rock consisting

almost entirely of silica, is mixed with carbon and with a thick liquid hydrocarbon in sufficient quantity to bind the mass. The mixture is pressed into moulds and dried in a stove.

To prepare a cement, the bricks are crushed to powder, and mixed with a little fresh hydrocarbon, or the mixture before pressing may be used.

[*No Drawings.*]

A.D. 1883, January 8.—No. 97.

WELDON, Walter.—Manufacture of aluminium and alloys of aluminium.

Anhydrous aluminium chloride is obtained by fusing cryolite or aluminium fluoride with calcium chloride, or with anhydrous chloride of an alkaline metal, "or of an alkaline earth metal "other than calcium." By using a corresponding bromide, iodide, or sulphide, aluminium bromide, iodide, or sulphide is obtained. The product of the described operation, strongly heated with sodium, manganese, or an alloy of these with other metals, yields aluminium or its alloys.

[*No Drawings.*]

A.D. 1883, January 10.—No. 144.

GROTH, Lorentz Albert.—(*A communication from Lorentz Ramberg.*)—Washing clay etc.

Relates to apparatus for washing clay and similar substances. The apparatus consists of a pyramidal drum of hard wood, screwed to flanges connected by radial arms to an axis which runs in wooden bearings. Inside the drum, which may be lined with iron, is an iron spiral screwed to iron elbows fixed inside the drum, and provided with projections and knives. In the centre of the large end of the drum is an aperture to which is fixed a conical head into which fits a feed funnel. Gratings of finely-pierced iron are fitted at one end of the cylinder, which is also provided with a projecting funnel over a delivery shoot. The drum is rotated by an endless cord or strap. The material to be washed is fed in at the feed funnel, whilst the drum is rotating and water is flowing in. The material is carried forward and, falling on the knives, is broken up. The

washed material passes through the grating into a trough, whilst the stones and coarse matter pass away by the delivery shoot.

[*Drawing.*]

A.D. 1883, January 12.—No. 200.

HADFIELD, Robert.—Manufacture of steel.

By adding to iron or steel a very much larger proportion of manganese than has hitherto been practicable, namely, from 7 to 20 per cent., the inventor produces a steel easily cast and requiring neither tempering, rolling, forging, or hardening. The proper proportion of rich ferromanganese is added to melted steel or nearly decarbonized iron in a reverberatory furnace, and mixed by stirring ; the alloy is then ready for casting into ingots. For armour plates 10 per cent., for railway wheels 11 per cent., and for steel togs and tools 12 per cent., of manganese are suitable.

[*No Drawings.*]

A.D. 1883, January 15.—No. 226.

VON NAWROCKI, Gerard Wenzeslaus.—(*A communication from W. G. Otto.*)—Producing homogeneous castings.

The molten metal is stirred by a block of marble or other mineral evolving carbonic acid, the block being secured to the stirrer by dovetail or T-shaped grooves.

[*No Drawings.*]

A.D. 1883, January 16.—No. 254.

FRANK, Adolph. — Manufacture of porous silicious material etc.

Relates to the manufacture of a porous silicious material, applicable to building, filtering, grindstones, and other purposes. Finely-divided silicious earth, such as infusorial earth is mixed with alkalies, alkaline earths, or magnesia, or salts of these, such as carbonates, sulphates, nitrates, phosphates, chlorides, and fluoride, and with organic materials, such as sugar, starch, ground wood, blood, glue, gluten, ground bones, or organic salts of the alkalies or alkaline earths, such as tartrate of potassium or sodium; water or other liquid is added and the mass is moulded into blocks of suitable form which are dried

and fired at a high temperature. Borax, water-glass, and other basic compounds of boracic and silicic acids may be used, and the blocks may be enamelled by exposing them while hot to alkaline vapours.

[*No Drawings.*]

A.D. 1883, January 16.—No. 265.

SHARP, Thomas Budworth.—Machinery for separating solids of different specific gravities.

The machine consists of an upward-current ore-washer or elutriator, applicable also to concentrating or washing metallic precipitates, jewellers' or casters' or smelters' sweepings, &c. Water is admitted into a pit or tank through a side tube furnished with a regulating-valve. A hinged cover fits on this tank and through it passes a central tube widened above to receive the funnel neck of a hopper for feeding the ore. The ore or other powder falling down the central tube meets the ascending current of water, and the lighter particles are carried up and overflow the expanded end of the tube with the water on to the hinged cover, which is furnished with sides to form a shoot for carrying the waste or tailings away. In a modification the shoot is separate from the cover and is fixed round the tube higher up.

[*Drawings.*]

A.D. 1883, January 22.—No. 362.

DE OVERBECK, Gustavus, Baron.—(*A communication from Hermann Niewerth.*)—Process and apparatus for the production of metallic aluminium and aluminium alloys.

By smelting a mixture of ferro-silicium with aluminium fluoride or chloride, or cryolite, an alloy of iron and aluminium is obtained; on melting this alloy with copper, iron separates and aluminium bronze is obtained.

A second process consists in heating a chlorine or fluorine compound of aluminium with a sodium or potassium generating mixture, such as sodium carbonate, coal, and chalk.

The third process is best conducted in a special furnace, consisting of two gas producers placed in alternate communication with a central smelting-furnace, and supplied alternately

by an air and a steam blast. The centre furnace is charged with a mixture of carbonate of soda, carbon, sulphur, and alumina, and above this sulphate of alumina, covered in its turn with a mixture of sodium and potassium chlorides. Or aluminium sulphide may be used direct, or in mixture with sulphides of sodium, potassium, or copper ; in the latter case an alloy of copper is obtained.

[*Drawings.*]

A.D. 1883, February 1.—No. 557.

ABEL, Charles Denton.—(*A communication from Ludwig Mautner, Ritter von Markhoff.*)—(*Provisional protection only.*)—Washing cereals, coffee, and other grain.

A cylindrical casing having a lower conical end terminating in a branch is provided with a removable cover and fitted with a vertical spindle rotated through pulleys and bevel gearing and carrying perforated or openwork vanes constructed of a framework covered either with longitudinal or transverse wires or bars, or with both. The supply and discharge pipes are so arranged by means of a three-way and a four-way cock that the cleansing-liquid may enter at the top of the vessel and be discharged at the bottom, or enter at the bottom and be discharged at the top ; the discharge pipe is carried above the apparatus to keep the contents of the vessel under the required pressure. The grain to be washed is fed into the apparatus through a branch fitted into the cover, and it is discharged through another branch at the bottom of the cylinder provided with a rotatable perforated or wire gauze valve, and closed by a cover ; the valve retains the grain while the water flows off. The apparatus may be arranged horizontally.

[*No Drawings.*]

A.D. 1883, February 6.—No. 633.

CROSS, William.—(*Provisional protection only.*)—Manufacture of finely-divided lead alloys etc.

Relates to the production of finely-divided lead etc. for use in secondary batteries, and for the manufacture of white lead and other purposes.

Lead, or its alloys, is melted or rendered viscous, and, in this state, is passed through an opening into a suitable chamber.

While it is thus passing, blasts or jets of any suitable liquid or gaseous fluids act upon the lead, by which means it is reduced to a finely-divided condition.

In one plan the molten lead is caused to flow through suitable slits or holes in a series of fine streams, or in a thin sheet, from the bottom of a pipe ; the thin sheet extends partly or wholly along the length of the pipe. The blast pipe is placed beneath the lead-carrying pipe. The finely-divided filaments are collected in the chamber which holds the pipe.

In another plan, the viscous lead is discharged with great velocity into a chamber, thus finely dividing it by its passage through the atmosphere contained in the chamber. The vessel is revolved at a high velocity and the streams of lead issuing from it are met by blasts of air or other fluids. Or one set of streams of air or of lead may impinge upon another set.

When lead is required in the metallic state the blast may consist of air deprived of its oxygen.

The finely-divided lead may be matted or otherwise made into plates etc. for secondary batteries. It may be more or less coated with oxide by the employment of a blast containing oxygen. Thus coated, the plates may be used for secondary batteries.

[*No Drawings.*]

A.D. 1883, February 14.—No. 811.

LOTTER, FRITZ.—Extracting and refining nickel and cobalt.

To obtain nickel free from oxide and in a form fit for casting, rolling, and alloying with other metals, oxide of nickel is mixed with a small proportion of oxide of manganese, and the mixture made into blocks and reduced in a furnace. When the intimately mixed metallic nickel and manganese are melted down to form casting or alloys, the manganese oxidizes in preference to the nickel, and forms a slag or scoria of oxide, leaving the nickel pure and ductile. A similar process may be used to obtain pure cobalt.

[*No Drawings.*]

A.D. 1883, February 17.—No. 875.

CLARK, JOHN.—Reducing metals from their ores or chemical compounds.

The sun's rays are concentrated by means of a large burning-glass, or mirror, or combination of the two, upon the metallic compound or mixture to be reduced, which is moved forward into the focus by a feeding-arrangement as fast as reduction occurs, the reduced metal falling into a receiver. When oxides or chlorides are to be reduced a stream of hydrogen is directed into the focus, and for a mixture of oxide and chloride carburetted hydrogen may be used. Oxides are mixed with charcoal and the mixture compressed before introduction into the furnace. Sulphates are dehydrated, mixed with charcoal, and then heated to redness in a reverberatory furnace to produce the oxides, which are afterwards reduced by the burning glass. The oxide and chloride of platinum require no reducing-agent, but the burning-glass is used to consolidate the reduced metal and make it weldable, and to refine native platinum by volatilizing foreign metals. The lenses and mirrors are provided with adjustments for bringing them opposite the sun.

[*Drawing.*]

A.D. 1883, February 20.—No. 934.

ARMITAGE, ARTHUR.—(*Provisional protection only.*)—Manufacture of steel and alloys to be used therein.

Steel of increased hardness and ductility is produced by introducing 0·1 to 2·0 per cent. of chromium in the form of "manganiferous chromeisen" or of "chrome-spiegel." These chromium alloys are made by smelting, in blast furnaces, mixtures of manganiferous iron ores and chrome iron ores with lime and alumina compounds, so as to produce a highly basic slag; excess of manganese is also used to prevent chromium slagging out. If manganiferous chromeisen (*i.e.*, an alloy containing noticeable quantities of silicon and graphite) be produced it is mixed with pig iron and the mixture converted into steel. Chrome-spiegel, which contains only very small proportions of silicon and graphite, may be added direct to the converter metal, with or without ferromanganese.

[*No Drawings.*]

A.D. 1883, February 20.—No. 944.

SCOTT, ANNIE ELIZA.—Separating gold and other metals from their ores.

Relates to processes for extracting metals and "electroplating "direct from the ore" depending on the electrolysis of sea water or similar solutions.

For extracting aluminium, emery, kaolin, or other aluminous compound is placed in a tank of acidified sea water containing electrodes of gas coke and aluminium. A layer of benzoline protects the liquid from the air, and after some time the liquid is dialyzed or filtered and the filtrate precipitated with carbonate of potash; the salt is then mixed with sodium chloride and cane sugar, dried, and heated strongly. The metal is mixed with the scoria, and may be separated by again heating violently with sodium chloride. The latter part of the process applies to magnesium, calcium, silicium, and all metals of that class. The process for extracting and refining gold is similar to the last. The sea water is placed in a porous vessel or dialyzer together with the ore and a block of carbon, and in an outer vessel is a plate of amalgamated zinc. The gold contained in the solution is eventually precipitated by sulphuretted hydrogen or sulphate of iron, and reduced to a regulus by ordinary means.

Palladium, platinum, etc. are successively extracted by pouring in fresh solution and continuing the electrolysis.

Silver, lead, etc. remain with the matrix, and may be extracted from the residuum.

Preparing amalgams by electrolysis.—For some metals it answers better to mix the ore with solid mercuric chloride and electrolyse the mixture in cells with platinum electrodes, the reduced metal being obtained as an amalgam.

Metallic salts, obtaining by electrolysis.—All metals are dissolved by this electrolytic process, and thus compounds of vanadium, niobium, aluminium, cerium, chromium, manganese, nickel, etc. can be obtained. The process is described as applicable to extracting valuable salts from graphite, coal, coke, ashes, soot, etc.

Carbonates of potassium and sodium may be crystallized out as bye-products from the electrolytic liquor when alkalies have been used to precipitate the metallic oxides from solution.

[*No Drawings.*]

A.D. 1883, February 21.—No. 958.

DAVIES, DAVID.—(*Provisional protection only.*)—Casting ingots of iron, steel, and other metals.

The ingots are cast with their narrow ends at the bottom and broad ends above. The upper edges of the mould have slots opposite one another, made flush with a filling while the metal is being cast. Afterwards the filling is knocked out, and the ingots lifted directly by inserting the tongs. Ingots thickest in the middle are cast in moulds made of two parts, the upper part being removed for stripping.

[*No Drawings.*]

A.D. 1883, February 27.—No. 1044.

JOHNS, William Albert.—Manufacturing tin and terne plates.

An improved tin or terne plate is made by coating the "black plate" first with lead or the usual alloy of lead and tin, and afterwards with a thin coating of pure tin by passing them between squeezing-rollers, over which a thin stream of molten tin is allowed to trickle.

Several improvements in apparatus for making tin plates are described and claimed, viz. :—

Two metal or dipping baths are combined with a single grease bath, the whole being enclosed in a metal casing containing the heating furnaces and rendering the apparatus self-contained. The metal baths are drawn as curved or semicircular in section, terminating at each side of the bottom of a U-shaped grease bath with partial central partition. Guides are placed in the entering grease pots with their lower ends above the surface of the molten metal; corresponding guides in the metal bath have their entering ends submerged below the metal. The guides are formed each in one piece by casting or otherwise, and are mounted in a slotted frame and connected by a right and left handed screw so that they are adjustable for plates of different width. Each groove in the guide bars has a central partition tapered on each side to accommodate the crossing of the alternate plates by which they are pushed forward. These partitions terminate some distance below the grip of the first pair of finishing-rollers at the exit ends of the baths. When the guides have but a single groove the tapered partition is continued at the entering end of the bath up between the ends of the feeding-rollers, which are recessed for the purpose, thus facilitating the placing of the successive plates in their crossed

position. Longitudinal plain guide bars are used to press against the middle of the plates on each side and prevent buckling. Below or above the first pair of finishing-rollers is a pair of curved metal plates pressed against the issuing tinned sheets by weights, and intended to remove scurf and surplus metal. Between the two pairs of finishing-rollers is a pair of perforated metal rubbing-rollers, the surplus metal removed by which escapes through the perforations. When a cradle is used for re-dipping, a pair of rubbing-bars pressed together by counterweight is used above the finishing-rollers after the first dipping.

The plates are gripped on their edges on their exit from the bath by a fork with elastic prongs opening to the width of the plates ; or the prongs may be made to grip by screws or cams, and the fork handle may slide on a vertical shaft and be adjusted as to height by a screw.

[*Drawing.*]

A.D. 1883, March 6.—No. 1203.

LAKE, HENRY HARRIS.—(*A communication from Martin Armstrong Howell.*)—Manufacture of files, taps, dies, and other cutting-tools.

Relates to a special cementation process. Reference is made to Specification No. 5602, A.D. 1881. The blanks, which are cast iron, are decarburized, if necessary, by "cementing" in oxides or other matter having an affinity for carbon, or are simply annealed, and are then finished by grinding, shaping, and cutting, without forging or hammering. They are placed in a rectangular or cylindrical case, preferably of an alloy of 1 part nickel to 4 or 5 parts iron, closed by a cover provided with a clamp. The case is placed in a furnace or muffle, and hydrocarbon vapour is passed in from a holder until all air has been expelled through a tube which is then closed. When the proper heat is reached, the tube is opened and the vapour is lighted, to show its freedom from air and to circulate the vapour in the case. The pressure is then increased in the holder. After the operation is completed the connecting tubes etc. are closed, and the case is detached from the reservoir and removed to cool. Sometimes the tools are separated by layers of charcoal saturated with oil or other hydrocarbon, or hydro-

carbon is placed in the case, the tube being connected with a gas holder or india-rubber bag or the like. The first vapours produced are allowed to escape, and the remainder, after all air is expelled, is passed into the holder which has been exhausted of air, and which afterwards returns the vapour as above.

[*Drawing.*]

A.D. 1883, March 7.—No. 1220.

RIDEAL, SAMUEL.—(*Provisional protection only.*)—Ingot moulds employed in the manufacture of iron, steel, and other metals.

Ingot moulds for casting iron, steel, &c. from Bessemer converters, Siemens' furnaces, etc. are made with an outer casing of metal, preferably sheets of rolled steel, divided vertically and held together by hoops, straps, screws, bolts and nuts, &c. An inner shell is made of refractory material, by preference magnesian limestone, old firebricks, and coke, calcined, ground, mixed to paste with mineral oil, then rammed into moulds and heated to redness, and when cold surrounded by hoops of metal. This inner shell is supported on angular bars riveted to the bottom of the metal casing, with an annular space between them which is filled with asbestos, silicate cotton, slagwool, coke, ashes, or other porous non-conducting material. The inner shell is protected by thin bands of metal at intervals; the surfaces are washed with a mixture of bran, pipeclay, lime, plumbago, and water.

[*No Drawings.*]

A.D. 1883, March 15.—No. 1385.

LAKE, HENRY HARRIS.—(*A communication from the Société des Couverts Alfénide.*)—Manufacture of bearings for shafts or axles, and of valves, cocks, or other parts of machinery.

German silver, containing copper 60 parts, zinc 15 parts, and nickel 25 parts, with one-tenth or one-fifth per cent. of magnesium added, is used for casting bearings and bearing surfaces.

To avoid air holes the central channel of the mould is branched, so as to introduce the metal in several streams.

[*No Drawings.*]

A.D. 1883, March 16.—No. 1407.

BOWEN, THOMAS.—(*Letters Patent void for want of final Specification.*)—A process for extracting copper, silver, and gold from ores and regulus.

The material is calcined until the sulphur is reduced to 5 per cent., and then mixed with common salt and again calcined. The calcined and chloridized ore is mixed with a little bleaching-powder or peroxide of manganese and lixiviated in tanks with false bottoms by brine acidulated with muriatic acid until the copper, silver, and gold dissolve. The solution may be treated by known methods, as, for example, precipitation with sheet copper and afterwards with scrap iron, and the mother liquor may be used over again for lixiviating fresh ore.

[*No Drawings.*]

A.D. 1883, March 17.—No. 1423.

SILCOCK, REGINALD HEBER.—Apparatus for sorting and screening coal, ores, etc.

An endless screen, formed of wire twisted round bars at short distances apart, or other suitable material, is caused to travel over rollers or drums above a hopper or wagon. The screen travels between two planks on edge or other framing to form a kerb. The coal &c. is shot on to the screen, and pickers at each side pick out the stone and other substances as the material travels along the screen. In cases where small meshes are required strips of iron are placed between the wires, their ends being bent over to prevent slipping.

[*Drawing.*]

A.D. 1883, March 22.—No. 1519.

STRUTHERS, ALEXANDER JAMES.—Pulverizing and treating diamondiferous ore.

Relates to the preliminary treatment and pulverization of diamondiferous ore, and consists of improvements on the inventor's previous Specification No. 4104, A.D. 1881. The diamondiferous ore is subjected to the action of hot air, furnace gases, and steam after being partially broken by crushing-rollers, and passed on to a disintegrating roller or rollers, thence to a screen, and finally through elastic grinding-rollers, after which

it is washed in the usual machines. If shale or other sulphur-containing fuel is used in the furnace the gases will contain acid fumes which assist the disintegration. A number of arrangements for the purpose are described and figured. In one form the ore passes between crushing-rollers into a furnace provided with a ring flue furnished with inlets for admitting furnace gases to the falling ore. A feeding-roller discharges the material on an endless band, which carries it through a steaming-chamber to a disintegrator, whence it is elevated to a screen and passes through crushing-rollers. In modifications the steam and furnace gases are supplied to different or the same parts of one chamber, which may be surrounded by a worm-wheel and rotated by power.

[*Drawing.*]

A.D. 1883, March 27.—No. 1553.

LEWTHWAITE, John.—Metals and alloys or mixtures of the same.

Iron, steel, bronze, bell metal, brass, gold, silver, zinc, tin, lead, and other metals and mixtures are mixed after being melted and run from the furnace with titaniferous iron or steel sand, "commonly known as New Zealand iron sand or steel " sand and sometimes as magnetic iron or steel sand."

Castings are made with the various mixtures.

Wrought iron heated, sprinkled with the sand, and hammered, becomes steeled or hardened on the surface.

Steel is produced by smelting the sand in a blast furnace and withdrawing the blooms of metal by a rod.

[*No Drawings.*]

A.D. 1883, March 27.—No. 1555.

IMRAY, John.—(*A communication from Henri Herrenschmidt and Marmaduke Constable.*)—"Extracting cobalt and manganese " from their ores."

The ground ores are assayed and sufficient ferrous sulphate is added to convert the cobalt and manganese oxides into sulphates. The mixtures may be roasted and then lixiviated ; or it may, in the state of a slime with water, be boiled, or, not so advantageously, be left to stand some time with cold

water. The solution of cobalt and manganese sulphates obtained may be treated in any known way to obtain the respective oxides.

[*No Drawings.*]

A.D. 1883, May 31.—No. 1628.

WATERHOUSE, JAMES CARTLEDGE.—Crucibles and melting-pots.

Aluminous fireclay, plumbago, and asbestos, in stated proportions, with smaller proportions of magnesia and quartz, all powdered, are moulded with liquid sodium silicate to the desired shapes ; and in some cases a mixture of sodium silicate, asbestos powder, magnesia, and silex is applied as a coating to the vessels made.

[*No Drawings.*]

A.D. 1883, April 3.—No. 1660.

RILEY, JAMES, and PACKER, GEORGE SMITHERS.—(*Provisional protection only.*)—Manufacture of steel.

Steel of improved quality for casting and rolling is made by adding to molten steel in a ladle ready for casting, 1 per cent. or less of an alloy of iron and silicon with or without manganese. The alloy contains 10–13 per cent. of silicon and 18–24 per cent. of manganese if that metal is used.

In casting steel ingots a quantity of ground carbon is placed on the top of the molten steel as soon as it is run into the ingot mould. For thick ingots the top end of the ingot is surrounded with similar material combined with a suitable cement, the top of the mould being recessed for this purpose.

[*No Drawings.*]

A.D. 1883, April 6.—No. 1730.

SPENCE, WILLIAM HEATHER.—(*A communication from Emil Möhlan.*)—Covering iron and steel with lead or its alloys.

The surface to be coated is cleaned with dilute sulphuric or other acid. It is then treated with hydrochloric acid containing dissolved zinc, and afterwards tinned in the usual manner.

The lead or its alloy is fused on the tinned surface in small

quantities by the flame of an oxyhydrogen blowpipe and added as required. The heat from the blowpipe raises the temperature of the iron sufficient to fuse the lead, and for some purposes the iron is heated by other means.

[*No Drawings.*]

A.D. 1883, April 7.—No. 1754.

ELMORE, FRANK EDWARD.—Electrodes.

Relates to the construction of electrodes for electrolytic and like purposes, such as the electrodeposition or the electro-refining of metals, the separation of metals from their ores, the electro-decomposition of chemical solutions, the electro-amalgamation of precious metals, etc.

The electrodes are enclosed or surrounded by a covering of porous material such as felt, asbestos, flannel, porous clay, or other material capable of retaining any residue or impurity which may occur in the electrode. The copper or other anode may be suspended within a wooden rectangular frame, the faces of which are covered with porous material.

Electrodes for use in the electro-amalgamation of gold and silver are constructed of carbon or a difficultly-oxidizable metal, such as platinum surrounded by a porous envelope. In working such apparatus, a small quantity of salt or acid is preferably added to the paste of ore or water separating the electrode from the amalgam.

[*Drawing.*]

A.D. 1883, April 7.—No. 1758.

HUNTINGTON, ALFRED KIRBY, and KOCH, WALTER EDWARD.—Improved amalgamating apparatus.

The pulverized ore or tailings are fed into a tube rotating vertically in the amalgamator containing mercury or molten lead (if heated). The lower part of this tube carries tapering, ovate, rotating arms, through slits in the back surfaces of which the produced ore escapes into the mercury, parting with its gold or silver particles as it rises to the surface. Horizontal and vertical baffles prevent rotation of the mercury. By means of a slit in the upper portion of the feed tube the ore may descend again for repeated treatment.

[*Drawing.*]

A.D. 1883, April 9.—No. 1772.

LUTHER, William Henri.—(*Provisional protection only.*)—Baths for containing molten zinc or other molten metals.

The baths for containing molten zinc, tin, lead, etc. for the operations of galvanizing, tinning, lead-coating, etc. are constructed of an inner and outer casing, with or without an interspace filled with fireclay or similar material. The inner casing is preferably of best welded iron or steel plate, and the outer and thicker casing of malleable or cast iron. Worn-out baths of the common kind may be used as outer casings. The outer shell may be of corrugated iron.

[*No Drawings.*]

A.D. 1883, April 10.—No. 1797.

JOHNSON, John Henry.—(*A communication from Nathan Woodhull Condict, Junr.*)—Stamping or pulverizing minerals.

A mortar contains an anvil which is held to the bottom thereof by an annular lining and a ring, detachable elastic linings being inserted between the lining and mortar. A perforated casing above the mortar is provided with an annular deflector and with a cover, the opening of which is closed by a ring made in two parts bolted together between collars on the stamp rod and a canvas &c. ring attached to the former ring and to the cover. The material is fed into the casing through a pipe fitted with a valve connected by a link to a weighted lever. The pulverized material is drawn by means of a fan through perforations in the cover of the casing into a box, and thence through a pipe into a receiver in which the coarser particles are deposited ; the rest passes through the fan into a second receiver. This may be made of canvas etc., or may be a box separated by a vertical partition into two compartments communicating by perforations at the bottom and containing water ; the air from the pulverizer is induced by a fan from one compartment into the other, and a screen extending across the first compartment below the water level causes the deposit of the material. In some cases the pulverizing may take place without the employment of an air current. In an arrangement for automatically operating the valves of duplex steam stamps, a hollow casting is secured to the top of the frame and contains a chamber in which steam at low pressure is maintained. The piston of a

steam cylinder is connected to the spindles of the valves working in the steam chests of the stamp-rod cylinders. The steam chest of the cylinder contains a slide valve having two rods terminating in slides adapted to guides, and carrying rollers against which bear the inclined upper ends of alternately reciprocating rods. These are each connected to an arm on a rock shaft which also carries other arms connected to opposite ends of a lever secured to another rock shaft. The latter shaft carries a segment on the edge of which a brake shoe, pivoted midway between its ends to a block free to slide vertically in a projection on the casting, is caused to bear by spiral springs. To the segment or the rock shaft is secured a lever fixed a little out of the central line and having two arms which overhang flanges, preferably forming part of the stamp-rod couplings. The levers being alternately struck by the flanges, the slide valve of the cylinder is caused to reciprocate through the said vertical rods, and the valves of the main cylinders thereby actuated in reversed phases. The spindle connected to the piston is provided with discs which strike against projections having recesses packed with leather &c. Instead of two vertical rods, one having two inclinations acting on two rollers on a single slide, or a cam for thus operating and locking the valve, may be used. In the case of single steam stamps, a chamber is formed within a supporting casting, as above, and the stamp rod slides in a guide secured to cross-bars on the frame. A small steam engine is secured to the frame, and its horizontal slide valve is operated by an arm on a spindle which passes through the steam chest, and which has a lever connected by a rod to an arm on a shaft hung by a bracket to the frame, and to this shaft is secured another arm connected by a link to a bent arm pivoted at its lower end to a frame, and directly or by a link having a screw coupling by which it may be lengthened or shortened, to an elastic arm suitably bent and pivoted at its upper end to a block adapted to guides on the frame and controlled by a screw. The latter arm may be rigid and acted on by a spring contained in a casing secured to the frame, and bearing against a rod jointed to the arm. The valve spindle of the main cylinder is connected to the piston-rod of the small cylinder by a rock shaft carrying two arms, one connected to the valve spindle and the other to the piston-rod. During the upward stroke of the main piston, a flange of

the stamp-rod coupling strikes the first bent rod, and thereby operates the slide valve so as to cause the downstroke, during which the flange strikes the second bent arm and causes the reversal of the valve.

[*Drawings.*]

A.D. 1883, April 11.—No. 1836.

ARCHER, THOMAS.—(*Provisional protection only.*).—Apparatus for cleaning and separating lead and other metallic ores.

Relates to a pneumatic ore cleaner or separator. A pipe placed in a slightly inclined position is rocked or revolved while the crushed ore is fed through a hopper at the upper end and a blast of air introduced at the lower one.

[*No Drawings.*]

A.D. 1883, April 18.—No. 1967.

TINN, JOSEPH.—Galvanizing sheet iron.

The plates are passed continuously through the bath by rollers. The feed rollers are arranged at an angle above the surface of the bath, through which the plate is guided by curved guides to the finishing-rolls. The lower finishing-roll is half immersed in the bath and the upper roll may be hollow and kept warm by steam or hot air. A fluted or grooved roll is arranged to remove the scruff or crust. The plates may pass from the finishing-rolls to a travelling table and be carried direct to the sorters.

[*Drawing.*]

A.D. 1883, April 19.—No. 1995.

GADSDEN, HENRY ARTHUR.—(*A communication from Emerson Foote.*)—" Obtaining aluminium."

A process is described for obtaining aluminium chloride, consisting in grinding a calcined mixture of corundum, bauxite, or the like, with an alkali metal fluoride and fluorspar, mixing the powder with charcoal, starch, or oil, making into balls, and baking to a spongy mass, which is then heated in a suitable retort while a current of chlorine is passed through, the aluminium chloride formed being distilled over into a receiver. The chloride may be purified by passing its vapour through a vessel

charged with iron turnings, and condensing in a receiver, as crystals.

To obtain a product containing aluminium fluoride, corundum or other aluminium-containing material is calcined with fluorspar, and the mass when cold is powdered, mixed with sodium chloride and potassium chloride in stated proportions, made into balls, and dried.

To obtain aluminium from the chloride, the latter is placed in a retort connected by a tube to another retort charged with sodium carbonate, 20 parts; charcoal, 16 parts; and chalk or lime, 5 parts; which, on heating, liberates sodium vapour. The latter passes to the first-named retort which is also heated, and liberates metallic aluminium from its compound.

To obtain aluminium from the mixed fluorides, the latter is placed in a retort having a false bottom or perforated diaphragm placed some distance above the bottom of the retort. Sodium vapour is passed in from another retort as before.

[*No Drawings.*]

A.D. 1883, April 20.—No. 2012.

TAYLOR, HENRY FRANCIS, and LEYSHON, GEORGE.—"Manufacture of fluxes or material used in the manufacture of "plates coated with tin terne or other metals."

The "flux" or chloride of zinc used in tinplating is made by dissolving zinc to saturation in hydrochloric acid, with or without heat, and afterwards treating the solution with charcoal and lime, magnesia, chalk, or other alkaline earth to neutralize free acid.

[*No Drawings.*]

A.D. 1883, April 23.—No. 2054.

HARGRAVE, JAMES.—Machinery for cleaning, blacking, and polishing boots and shoes, also applicable to other purposes.

A standard carries two arms on each of which a rotating spindle is mounted horizontally. Each spindle carries a brush; two pairs of brushes are required; the one for removing the dirt and the other for polishing, and they are screwed on the spindles so as to be readily changeable. Both brushes of a pair act simultaneously and are arranged to

approach and recede from each other, the upper arm being pivoted on the standard and stops preventing their too close approach. The apparatus is worked by a hand-wheel or by foot or other power, and pulleys and bands. Suitable rests and a guard are provided, and also a covering of felt or india-rubber for the hand of the operator for insertion in a boot or shoe ; or a last may be inserted for the same purpose.

In a modification, instead of changing the brushes the apparatus has four spindles driven from a common source, one pair carrying dirt brushes and the other polishing-brushes.

In another modification, three rotating spindles are used, placed vertically. The central one occupies a fixed position, the others are carried by spring-held pivoted arms so that they can approach or recede from it, and the brushes are detachable and changeable. Four spindles may be used, the inner spindle being fixed and the outer ones movable.

The machinery is stated to be also applicable for cleaning metallic articles, plated or otherwise.

[*Drawings.*]

A.D. 1883, April 26.—No. 2122.

BOWEN, THOMAS, and NAPIER, JAMES.—(*Letters Patent void for want of final Specification.*)—Extracting gold from auriferous pyrites and other ores containing gold.

Calcined auriferous pyrites or other ore or regulus containing not over 6 per cent. of copper is mixed with 10 per cent. of salt and calcined in muffled or other calciners until a sample ceases to evolve nitrous fumes when treated with nitric acid ; the hydrochloric acid fumes and volatilized gold and silver may be condensed in towers. When cold the ore is mixed with 2 per cent. of chloride of lime, or with peroxide of manganese, and the mixture packed into tanks with perforated false bottoms covered with sacking and an acid tube dipping beneath the perforated bottoms. Hot diluted sulphuric or hydrochloric acid is poured through the supply tube and allowed to act on the mixture until the chlorine produced has dissolved the gold. The liquor is then run off by a tap at the bottom and the ore washed with water. Gold precipitated from the solution by known means such as ferrous sulphate or oxalic acid ; and silver also, if present.

[*No Drawings.*]

A.D. 1883, May 2.—No. 2243.

CLARK, Alexander Melville.—(*A communication from Soc. Anonyme "Fonderie de Nickel et metaux blancs,"* represented by *Charles Combier.*)—Manufacture of nickel and cobalt and alloys thereof.

Pure nickel and cobalt which can be cast, hammered, rolled, drawn, &c. are made by melting nickel and cobalt in a crucible with cyanide or ferrocyanide of potassium and oxides of manganese.

Ferro-nickel and ferro-cobalt are produced by adding iron to the mixture. The addition of a little aluminium will facilitate the operation.

[*No Drawings.*]

A.D. 1883, May 8.—No. 2321.

HESS, Bernhard.—Artificial stone for various purposes &c.

An artificial stone for building and paving blocks, floor plates, table plates, wainscoting, grindstones, mill stones, crucibles, acid-proof vessels, mill rollers, and as a substitute for emery. Serpentine or kindred minerals, soapstone, feldspar, mica, quartz, and fireclay are mixed in various proportions according to the article to be made, ground, moistened with water, and pressed into moulds of the required form ; they are then slowly dried and finally burned at a white heat. For making crucibles the material is worked on the potter's wheel as usual.

[*No Drawings.*]

A.D. 1883, May 10.—No. 2382.

STEWART, Alexander.—Improvements in blast and cupola furnaces and receivers for smelting iron and other metals and steel making.

The cupola or blast furnaces have a third zone of fusion with a third row of tuyères. The valve plugs of this upper row of tuyères have chain-wheels, and by a chain passing round the row a lever on one plug opens or closes all the tuyères of that row.

The receiver for molten metal has inlet and eject pipes with valves connected by branches with air blast, so that the surplus heat of the molten metal is utilized in heating the blast. In modifications compressed air can be forced into or over the

surface of the molten metal, on its way to the blast; the receiver can be mounted on a worm-wheel shaft and turned by a worm to agitate the metal; it may be horizontal, the air blast entering through axis of rotation.

Receivers made in the above fashion may be used for steel making; they and the tuyères and blast openings are lined with graphite, silica, magnesia, lime, alumina, asbestos and oxide of iron. Portable receivers on wheels are also described and are run on rails to and from the cupola furnaces. Cupola furnaces for lead and zinc smelting are water-jacketed, and connection between the tapping-hole and receiver is made by a counter jacketed box pierced by a hole, the issuing metal being cooled sufficiently to lute the joints. "To obtain better results with " some metals I employ jets of steam which are discharged " into the stand and blast pipes, and I may force in with " the air charges of chemical oxygen or other purifying " agents."

[*Drawings.*]

A.D. 1883, May 10.—No. 2384.

CROSS, James, and WELLS, George Isaac James.—The treatment of ores etc.

Relates to the treatment of ores or mixtures of lead and zinc with or without an admixture of silver or copper or other metals, reference being made to Specifications Nos. 633 and 2867, A.D. 1877, No. 269, A.D. 1879, and Nos. 1501 and 4932, A.D. 1880.

A rotary calcining-furnace is supplied with air through three doors, one of which admits air to the ashpit, a further supply being admitted through the second, which is level with the fuel and also serves as a fire-door. The third door admits air to the back of the furnace, and also acts as a sight-hole. The calcining-chamber consists of an iron tube which is rotated on rollers. It is inclined and the lower end is fitted within the walls of the furnace, the upper end being connected with a chamber in which the sulphurous fumes are condensed. The calcining-chamber is lined with refractory material and has projecting bricks which lift the powdered ore and drop it through the flame as the chamber revolves. The ore is fed through a hopper into the upper part of the tube. The draught through the

furnace is adjusted so that the ore may be thoroughly calcined by the time it reaches the bottom of the tube. The calcined ore falls from the lower end of the tube into a chamber from whence it is removed for further treatment. A chamber in the condenser serves to retain any portion of the ore which may have been blown through the tube by the draught. The circuitous passages in the condenser through which the sulphurous fumes pass on their way from the tube to the chimney are fitted with shelves on which some suitable absorbent is placed.

When treating an ore consisting of mixed lead and zinc sulphide, the ore is first calcined in the rotary furnace and is then transferred to cisterns for treatment with hydrochloric acid. The cisterns are preferably constructed of stone slabs, the slabs forming the bottom and sides being about 9 and 6 inches in thickness respectively. The joints are made water-tight by india rubber cords inserted in grooves. The sides are then clamped together. The cisterns are provided with covers, and with pipes through which high-pressure steam is supplied for the purpose of maintaining the acid solution at the high temperature which is requisite when the ore contains much lead. For the same purpose the cisterns are jacketed with hot air or steam. The solution when drawn off from the cisterns may be cooled by compressed air, or it may be exposed to the atmosphere by being run through a series of shallow troughs on its way to crystallizing-tanks. If the ore contains silver, the solution is run into a vat in which is fitted a vertical tube. A screw rotates within the tube and raises the solution into the first of a series of shallow troughs in which it passes to and fro and comes into intimate contact with pieces of zinc or spelter. By this means the lead salts in the solution are reduced to spongy lead which abstract the silver. After passing through the troughs the solution may be returned to the vat or, if sufficiently de-silverized, it may be diverted to the receiving-vat by suitable sluice-valves. The water is preferably separated from the zinc oxide in a filter press.

[*Drawing.*]

A.D. 1883, May 10.—No. 2386.

CROSS, James, and WELLS, George Isaac James.—

Extracting silver, lead, copper, and zinc from bluestone and other mixed ores.

Relates to the treatment of ores containing various metals in admixture. The pulverized unroasted ore is digested in hot hydrochloric acid in stone vessels to convert the lead into chloride. The liquid is then partly neutralized with lime, boiled, allowed to settle, and run hot into a filter formed by cakes of peat laid on a sheet of woven material, such as asbestos cloth, or on perforated tiles supported on a platform in a tank. The filter is heated by hot air or steam and pressure or vacuum is applied. The clear liquid is raised by a screw pump into a trough leading to a cooling-tank where the chloride of lead crystals are deposited, the liquid then passing into another tank where silver and residual lead are precipitated by adding a solution of soluble sulphide such as the drainage from alkali waste, or alkali waste itself. The whole is then filtered in a press, the expressed liquid receiving more sulphide to throw down zinc, or it may run to waste. Instead of depositing chloride of lead the metal may be extracted by treatment with scrap iron. The residue in the stone vessels is next washed with boiling water, or with chloride liquor, dried, calcined, and again treated with hydrochloric acid to dissolve zinc, copper, and silver, the liquid passing to a series of tanks, in the last of which it is neutralized with lime, then filtered in a press, treated with sulphide liquor, and again filtered in a press, the expressed liquid receiving more sulphide to throw down the zinc. The precipitate from the presses may be treated with hot hydrochloric acid and the chlorides of lead and silver separated from the copper sulphide by a solution of calcium or sodium chlorides. To obtain zinc as an oxide the process is varied by adding to the solution in the lime tank, previous to complete neutralization, an oxidizing-agent, such as bleaching-powder, to convert ferrous into ferric compounds. The neutralization is then completed and deposited iron oxide and alumina are removed by a filter press, and the clear liquid is treated with sulphide to get rid of lead, copper, and silver; it it again filtered in a press, and the zinc precipitated as oxide by further treatment in a separate vessel with milk of lime. Suitable agitators, press pumps, connecting pipes, etc. are provided.

[*Drawing.*]

A.D. 1883, May 10.—No. 2390.

ABEL, Charles Denton.—(*A communication from Michel Body.*)—Obtaining gold, silver, copper, and other metal from their ores.

The extraction is effected by amalgamation which is facilitated by electrolytic action. Silver and gold are precipitated by electrolytic action in a cast-iron drum containing a number of cast-iron balls. After mercury has been added an electric current is passed through the drum, whereby the union of the silver and gold with the mercury is facilitated.

[*Drawings.*]

A.D. 1883, May 21.—No. 2527.

CHESTER, Edward Descon.—(*Provisional protection only.*)—Amalgamating gold and silver ores, sulphurets, tailings, &c.

At the discharge of a battery box, or at the end of the table covered with amalgamated copper plates, is placed a revolving silvered and amalgamated copper cylinder, with a packing of rubber, leather, rope, &c. between it and the table edge to prevent loss of material. Another packing is placed at the lower and under part of the cylinder, and beneath this a trough to receive amalgam scraped off. A small amalgamated cylinder is driven by contact with the large one and rotates in a bath of sodium amalgam or mercury brightened by electrolytic action or otherwise. The copper plates may be connected with a galvanic current and the cylinder with the return wire to revive the sick mercury.

[*Drawing.*]

A.D. 1883, May 23.—No. 2573.

WILLIAMS, Frank Tamblyn, and HOWELL, John Charles.—Manufacture of porous or spongy plates.

This invention relates to the manufacture of porous or spongy lead or alloys of lead for use in secondary batteries for the manufacture of white lead and other purposes. In the following way blocks or plates of any predetermined size and shape may be obtained. When lead or its alloy is melted and allowed to crystallize slowly, highly-porous plates are formed by

inserting a perforated mould of the size and pattern of the plate required into the mixture of molten lead and crystals of lead, raising the mould out of the bath, and allowing the liquid lead to drain through the mould. The upper surface of the plate is then levelled by means of a piece of iron, and the plate is allowed to cool in the mould, and can be removed when required. The edges of the plate are trimmed by means of a circular saw and it is then ready for use.

[*Drawing.*]

A.D. 1883, May 23.—No. 2582.

DAMES, Charles Richard.—Preparing and refining fullers' earth.

The raw earth is formed into a slurry by means of a suitable grinding or reducing apparatus such as an edge-runner. The slurry runs into a catch pit provided with divisions, whence it flows to a "maggie" or separator and thence to settling-tanks provided with perforated pipes for running off the supernatant water. After settling, the material is removed to a drying-shed having a heated floor, or it may be dried by centrifugal or other means. The "maggie" or separator consists of a vessel fitted with longitudinal partitions and hinged transverse plates for arresting the stones etc. A series of catchpits or gauze sieves or strainers may be used in place of the separator. The reducing or breaking-up may be effected by the application of heat or air, and in some cases the fullers' earth is dried before the above treatment.

[*Drawing.*]

A.D. 1883, May 26.—No. 2631.

HADDAN, Herbert John.—(*A communication from Riley Porter Wilson.*)—Reverberatory smelting etc. furnaces.

Two or more reverberatory furnaces having inclined hearths serve as feeding-furnaces to a furnace having a depressed hearth to receive molten metal. Puddling doors are provided in the sides. The air for combustion enters at the sides and passes along flues under the hearths to the firebridge, through holes in which it escapes.

[*Drawing.*]

A.D. 1883, May 31.—No. 2710.

GROTH, Lorentz Albert. — (*A communication from Erwin Nicolaus.*)—Producing a protecting coating of rust on iron and steel.

Relates to a process called "patinaing" for producing a protecting coating of rust on objects of cast iron, wrought iron, or steel. The objects to be treated are first ground and polished. Objects of cast iron are then annealed, immersed in a pickle of a weak solution of sulphuric or muriatic acid to remove the annealing-scale, and then thoroughly scoured. Large objects such as statues or monumental castings, and articles of wrought iron or steel, do not need annealing before subjecting them to the "patinaing" process, which consists in covering the surface with a very thin coating of a dilute inorganic acid which is allowed to dry. The object is brushed or rubbed with clean rags, the rusting process repeated, and the object again brushed or rubbed with rags after drying. Finally, the article is warmed and painted over with linseed oil, dried in an oven or drying-room, and covered with colourless lacquer which can be made brilliant at any required parts by wax polishing. Castings thus heated become of a beautiful black colour when heated in a stove.

[*No Drawings.*]

A.D. 1883, June 1.—No. 2739.

BOULT, Alfred Julius.—(*A communication from Benjamin Faquant.*)—(*Provisional protection only.*)—Generating electric energy etc.

Relates to cylinders etc. for frictional electric machines. They are composed of iron, zinc, and platinum in the proportions of one pound of zinc, half an ounce of platinum, and twenty pounds of soft iron. The materials are cast in the desired form, oxidation being prevented by the platinum, heated to a cherry red and tempered in muriatic acid, and then again heated and tempered in a solution of sulphate of zinc.

[*No Drawings.*]

A.D. 1883, June 2.—No. 2754.

PITT, SYDNEY.—(*A communication from Andrew Rutherford Gray.*)—"Treating copper pyrites for the extraction of metals."

Treating copper ores by acids, so as to obviate loss of the latter. The ore is first roasted, then pulverized, and treated in vats with nitric acid. The solution is run off and silver extracted by known methods, after which the copper is precipitated by means of iron. The methods of treating the bye-products to obtain sulphuric acid, iron oxides, etc. are also described.

[*No Drawings.*]

A.D. 1883, June 7.—No. 2842.

SPENCE, WILLIAM.—(*A communication from Gottfried Stumpf.*)—Regenerative furnaces.

Relates to regenerative furnaces for glass-manufacture and metallurgical purposes. The material is fed through funnels to two hearths, and the gas from a generator passes alternately through two flues and over a reservoir consisting of one or more portable or stationary metal cuvettes, the walls of which are solid or hollow, and which may be lined with basic stones or firebricks. The escaping gases heat the other flue. Collecting-pipes, channels, or flues supply air from a blower through adjustable slots or nozzles to burn the generator gases over the hearth. The molten material passes over a bridge to the reservoir and, in the case of glass etc., may be refined by air blast. When hollow or double-walled cuvettes are used the blast may pass between the walls, thence passing through pipes or other channels to collecting-pipes. The blast may also pass through flues between the gas and air flues. The flues may be divided by a partition open at one end to increase the surface traversed by the blast. The wells of the hearths and bridges may be cooled as described with regard to the cuvettes, or the cooling may be effected by water, steam, or air issuing through a perforated plate, sieve, or rose-heads. For refining the materials the blast is stopped for a time. The gas from the generator passes through a channel into a changer, arranged so that by raising, turning, and again lowering two U-pipes the

channel is alternately connected with pipes which convey the gas to the cuvette while the waste gases escape through a flue. To increase oxidation of the molten material, pipes which may be removed when no blast is required, communicate with the hot air conduits and open into the material. These pipes might supply superheated steam which decomposes and acts similarly Steam may similarly be used in the melting-chambers. To abstract the maximum heat, the air entering through the outside wall is preferably introduced with increased velocity through a large number of small openings. The invention is applicable to melting furnaces for ores etc. worked by generator gas or by blast or by a direct reverberatory flame. The material is fed to the hearth through funnels or side openings.

The generator gas and heated air enter a flue and are mixed and conveyed to the matarial, by a blast from nozzles, or the nozzles may supply the blast where the mixed air and gas are entering the hearth. The molten material runs over a bridge into a refining-chamber, and after being further heated runs over a lower bridge into a second chamber. The two chambers may be in one, a tapping-hole being made in the furnace wall. The wall separating the gas and air flues may have a channel through which the cold air blast passes from the blower before use. The funnels may be supplied from hoppers closed above by a lid and below by a trap or plate balanced by a counterweight On opening the trap, the whole contents fall upon the hearth. The waste gases from the upper portion of the charge may be drawn off and utilized.

[*Drawing.*]

A.D. 1883, June 8.—No. 2867.

SUTHERLAND, Horatio.—Quartz crusher or mill for pulverizing quartz and other minerals.

The mill has a mortar-like part which is bolted to standards of the frame and may be cast in two pieces. It is fitted with a removable cast iron or steel ring having corrugations tapering away towards the bottom and secondary corrugations between these. A corresponding pestle-like part is provided with a ring similarly corrugated to the former ring, and is rotated by means of a shaft which is stepped into a cup-bearing carried by a spring, and has a bearing on a cross-bar. The shaft is driven

from pulleys by bevel gearing, and is adjustable vertically by a screw to obtain the required degree of reduction of the material. The pestle-like part is covered by an inclined shield which serves to direct the material thrown upon it, and the working space is covered by a ring. The product passes out through holes, being aided therein, in some cases, by a stream of water introduced between the two parts of the mill.

[*Drawing.*]

A.D. 1883, June 8.—No. 2874.

GREY, David.—Treatment of tin and terne plates.

As a substitute for palm oil for fluxing the plates, a mixture of linseed oil and resin oil with or without Rangoon oil, castor oil, and cotton oil may be used ; the mixture preferred consists of 65 parts linseed oil with 35 parts resin or pine oil.

[*No Drawings.*]

A.D. 1883, June 9.—No. 2888.

JOHNSON, John Henry.—(*A communication from Julien Varin.*)—(*Provisional protection only.*)—Obtaining aluminium and aluminium bronze.

The double chloride of aluminium and sodium (or other suitable salt) is kept in a state of fusion in enamelled-iron troughs heated by a special furnace supplementing the waste gases of a reverberatory furnace. The latter furnace is used to prepare electrodes of moulded plates of a mixture of alumina with powdered carbon and tar. One of these plates is used as positive electrode, and one of retort charcoal or aluminium as negative electrode, and immersed in the fused aluminium salt. On passing a current, aluminium is deposited, at first impure, but a pure deposit is obtained by changing the negative electrode as soon as the metallic impurities are deposited. As fast as aluminium is withdrawn from the liquid, the liberated chlorine attacks the alumina electrode and reproduces the chloride, keeping the bath constant ; the liberated carbonic oxide may be burnt in the furnace. Or to keep the bath constant, fresh chloride may be introduced from time to time, and the liberated chlorine conducted away to the retort

in which the chloride is manufactured. If copper is used as the negative electrode, aluminium bronze may be obtained by melting it with the deposited aluminium.

[*No Drawings.*]

A.D. 1883, June 12.—No. 2913.

FINCH, MARK, WILLOUGHBY, WILLIAM, WILLOUGHBY, JOSEPH, and WILLOUGHBY, SAMUEL.—Burning pyrites, calcining ores, etc.

Relates to a furnace for calcining ores such as pyrites, mundic, or other minerals containing sulphur, arsenic, or other foreign substances. The furnace consists of a continuous flue winding helically round a pillar or rising by steps. The walls may be made of fireclay and the shelves etc. of fireclay or cast iron or other suitable material. The ore is fed in through a hopper, is pushed along the flues through openings etc. guarded by sliding or other doors, and is withdrawn at the bottom. The gases pass out through an opening to a main flue. The furnace may be circular, rectangular, triangular, or polygonal, and the pillar can be replaced by a central well. This furnace is specially designed to burn small pyrites.

[*Drawings.*]

A.D. 1883, June 13.—No. 2945.

BUTTERFIELD, JOHN COPE.—(*Provisional protection only.*) —" Testing ores and substances containing antimony."

Antimony sulphide ores are crushed, finely ground, and sifted, and then placed in a series of tanks placed one above the other. The tanks are of wood or earthenware, and are supplied with valved outlets at bottom and pipes of earthenware or type-metal for passage of superheated steam. A strong, hot solution of ferric chloride is run into the top tank, and there boiled up and stirred with the ore. The antimony sulphide dissolves as chloride, with separation of sulphur and reduction of the ferric to ferrous chloride. The liquor is run next into the second tank, when the process is repeated, and so through the series. Fresh ferric chloride solution is then added to the partially-treated ore in the top tank, and the described process is repeated until the ore is worked off, and a

strong solution obtained of antimony chloride. The residue of the ore is washed and treated, if necessary, to obtain any precious metals that may be present. The antimony chloride and ferrous chloride solution is taken from the settling-vessel into a tank having a steam-coil pipe, is acidulated with hydrochloric acid, and scrap iron suspended in the heated liquor within a cage; antimony is precipitated, and ferrous chloride formed. To the latter solution, after separation, bleaching-powder and hydrochloric acid gas added; or chlorine or hot iron is passed through to obtain ferric chloride for re-use. Any excess over requirements of ferric chloride is precipitated by lime or chalk to obtain ferric oxide. The antimony obtained is washed, drained, dried, compressed, and melted.

[*No Drawings.*]

A.D. 1883, June 15.—No. 2991.

BOWER, ANTHONY SPENCER.—Muffle furnace for coating iron and steel articles with magnetic oxide.

Reference is made to the previous Specifications No. 862, A.D. 1876, No. 2051, A.D. 1877, Nos. 1280 and 4195, A.D. 1878, No. 3811, A.D. 1880, and No. 3304, A.D. 1881. The object of the present invention is to enable steam to be used in the same furnace as the combustible gases mentioned in the above-mentioned Specifications, either alone or with these gases. The produced gases are mixed with a regulated quantity of air, and after traversing a combustion chamber (filled with transverse open walls or baffles of loose bricks) which runs under the muffle return by a side flue and enter the muffle bottom at one end. After acting on the articles they pass through a longitudinal flue on the opposite side of the combustion chamber and then through two regenerative chambers in the lower part of the furnace, through which pass pipes for entering the incoming air. The air supply is regulated by a valve, and a steam pipe with regulating-cock is attached to the air inlet. When steam alone is used for oxidation, after heating the articles a chimney damper is closed and a special steam outlet opened, and the furnace gases are shut off from the combustion chambers by a damper placed at its entrance.

[*Drawing.*]

A.D. 1883, June 16.—No. 2995.

SELVE, Gustav.—Manufacturing zinc and other alloys.

To make zinc alloys with less loss of zinc etc. by volatilization, long crucibles are employed, supported on refractory blocks on the hearth of a gas furnace and having their heads projecting through the upper casing of the furnace. The copper or other less volatile metal is placed in the bottom of the crucibles and melted, and zinc and scrap bars (or other alloys) are then added at the top until the metal is pasty. The projecting part of the crucible being much cooler than the lower part, the zinc melts with little loss; water can be used for additional cooling. The furnace floor dips to the centre and is provided with a tapping-hole for metal in case of a crucible breaking.

[*Drawing.*]

A.D. 1883, June 19.—No. 3038.

LAKE, William Robert.—(*A communication from Edwin Jenkins, Alexander Law, and William Price.*)—Annealing chilled and other iron castings.

At the dullest possible red heat, the metal is immersed in a solution of treacle and water of specific gravity 1·005, or in any other suitable liquid not injurious to iron.

[*No Drawings.*]

A.D. 1883 . . . . . . No. 3038*.

Disclaimer and Memorandum of Alteration to the Specification of the preceding invention, filed March 11, A.D. 1885, by Edwin Jenkins, Alexander Law, and William Price.

[*No Drawings.*]

A.D. 1883, June 21.—No. 3072.

ROBINSON, Thomas, and ROBINSON, Joseph.—Apparatus to be used in casting iron.

Relates to portable apparatus for receiving molten iron from a cupola or furnace and delivering it to ladles. It is formed with an inlet passage and tap hole and may be provided with

tap holes for slag. The inlet passage retains impurities and may contain reagents or the like. A fireclay or like skimmer may be placed over the shoot of the cupola. The receiver may have a roof with a pipe or pipes communicating with the cupola, and may be supported on trunnions in bearings and discharge over a spout. U-shaped vessels, with an inlet passage formed by a partition, may be attached to moulds.

[*Drawing.*]

A.D. 1883, June 26.—No. 3160.

IMRAY, JOHN.—(*A communication from George Duryee.*)—Compound for lining furnaces, making filters, bricks, slabs, and refractory and non-conducting linings.

Molasses are mixed with highly-refractory fireclay or ground soapstone, and sometimes titanic iron and bauxite, combined with a small quantity of plumbago. Proportions are given in the Specification.

[*No Drawings.*]

A.D. 1883, July 3.—No. 3279.

STUART, CHARLES.—Coating and finishing tin, terne, or other metal sheets.

Bath with feeding and planishing apparatus and automatic register for making tin and terne plates. The bath is in section a semicircular ring, with curved guides to facilitate the passage of the plates through it. At one end are feeding-rollers with spring nipping-flanges and a switch which is turned alternately in different directions by the passage of every plate into the bath, and is connected with a counting and registering apparatus. At the exit end of the bath are planishing-rollers of asbestos made by compressing the fibres with boxes or holders and then arranging these to form a cylindrical surface on a spindle. Above the planishing-rollers is a pair of finishing-rollers covered with asbestos cloth.

[*Drawing.*]

A.D. 1883, July 4.—No. 3317.

CHINNOCK, ALFRED SINGER.—Separating impurities from china clay, umber, ochre, and like matters.

The clay etc., having been separated from its coarser impurities, flows from a spout on to an endless band of fine wire gauze passing round three rollers. The lowest roller, which is of sufficient weight to keep the gauze distended, has its axis fitted in vertical slots wherein it may be clamped if necessary. The water, carrying with it the fine clay, passes through the gauze into a tank, and from thence flows into settlers. The coarser matters are carried round by the gauze and fall to the ground, any adherent particles being washed off by a jet of water delivered on the inner side of the gauze from a pipe.

The rotation of the gauze may be effected by causing the stream flowing from the trough to act on a small water-wheel, or the water issuing from the pipe may be collected in a trough after passing through the gauze and made to act on a small water-wheel.

[*Drawing.*]

A.D. 1883, July 6.—No. 3350.

LLOYD, THOMAS.—Treating tin and lead dross and slags.

The dross is moistened with water, mixed with carbon, lime, and alkali (in the forms of soot or powdered coke, chalk, and the bye-products from nitric acid works), and smelted in a cupola or other furnace. The reduced metal is run out through the tamp hole, and a little lime thrown in the furnace and mixed with the cinder, which, after a second heating, yields a little more metal; the cinder is then rabbled into water. Slags ground to dust are subjected to the same process.

The furnace bottom is made of one entire brick.

[*No Drawings.*]

A.D. 1883, July 11.—No. 3421.

MARTINO, FREDERICK WILLIAM.—Manufacture of alloys of tungsten.

Phosphide of tungsten is produced by melting powdered metallic tungsten with phosphide of calcium or other alkaline or alkaline-earthy phosphide, or by direct combination of tungsten with red phosphorus, or by melting tungstic acid with red phosphorus.

The phosphide of tungsten so produced is added in small quantities to brass, bronze, phosphor bronze, nickel silver, and other alloys to prevent liability to tarnish &c. The phosphide is first melted with part of the copper, then with more of the copper or copper and nickel, and the zinc added last. An oxidizing-flame is used at first and most of the tungsten and phosphorus pass into the scoria, but sufficient remains to confer the properties on the alloy. An alloy resembling gold and tarnishing with difficulty is made by melting together 80–90 parts copper, three parts tin, six parts zinc, one part bismuth, and ten parts phosphide of tungsten.

[*No drawings.*]

A.D. 1883, July 12.—No. 3440.

JAMES, Thomas.—(*Provisional protection only.*)—Coating metal plates with tin, lead, etc.

Baths and machinery for coating metal plates with tin, lead, or other metals or alloys. Consists of a flux hopper with palm oil, tallow, or other grease above the molten metal, below which and below the surface of the molten metal are rollers rotated by power for carrying the plates to the receivers or cradles. The receivers are lifted by rods connected with levers actuated by a shaft, and the plates brought to a nearly vertical position for delivery to the finishing-rolls. The surface of the metal is kept free from scurf by a skimmer, self-acting or not. The plates are finally passed through the finishing-pot containing rollers for regulating the thickness of coating.

[*No Drawings.*]

A.D. 1883, July 18.—No. 3528.

HUTTON, William Ross, and GRANGER, Allan.—(*Provisional protection only.*)—Refractory material.

Fireclay and steatite or soapstone, with or without the addition of plumbago, all in a fine powder, are mixed with water into a pasty mass, which may then be moulded into bricks, blocks, retorts, pipes, or other articles in which a high degree of refractoriness is required.

[*No Drawings.*]

A.D. 1883, July 21.—No. 3585.

MILLS, Benjamin Joseph Barnard.—(*A communication from Georg Fischer.*)—(*Provisional protection only.*)—Crucible furnaces etc.

The charged crucibles are subjected to a preliminary heating in a furnace fitted with a heating-stove, before removal to the melting-furnace. The heating-stove consists of a cylinder lined with hollow cylinders of refractory material and furnished with a cap provided with flue and damper ; it is jacketed, and is raised and lowered on to the furnace bottom by chains and pulleys. The lower part of the furnace is movable, and after the preliminary heating of the charge is run upon rails to the melting-furnace, which is worked fast enough to require three heating-stoves as auxiliaries. To regulate the blast, a perforated plate is placed beneath the firegrate, and by means of handles its perforations can be made to coincide more or less with those of the grate. The furnace jacket, lining, and firegrate are made removable to facilitate rapid cleaning and cooling. The melted metal is run into a lined metal ladle supported on trunnions and capable of holding a whole charge ; it has a spout and slag hole, and is provided with a lid and isolating-jacket filled with sand etc. From this the metal is transferred to small transfusing vessels with two spouts, a groove for the tongs, and a hoppered lid.

[*No Drawings.*]

A.D. 1883, July 21.—No. 3586.

MILLS, Benjamin Joseph Barnard.—(*A communication from Georg Fischer.*)—(*Provisional protection only.*)—Annealing castings and drying and heating casting-moulds.

Relates to the construction of furnaces and apparatus for annealing steel castings, and for drying, heating, and re-heating casting-moulds. Relates also to retorts or wagons for holding work during the process of annealing.

Muffles or vessels for annealing small cast-steel goods consist of hollow cylinders made of metal or some refractory material and provided with covers, the projecting rims of which serve at the same time as flanges for the rails. The cylindrical bodies may have a smooth or undulated surface ; the latter to

augment the heated surface. For large castings trucks provided with covers are employed. Moulds are supported on platform wagons.

[*No Drawings.*]

A.D. 1883, July 25.—No. 3652.

THOMPSON, William Phillips.—(*A communication from George T. Lewis.*)—Treatment of complex ores for the separation or extraction of the metals contained therein.

Complex and refractory ores, containing lead, zinc, copper, antimony, arsenic, "and other base metals," besides silver and gold, or any of these, are roasted at a high temperature in a current of, preferably, heated air, in order to drive off as much as possible of the metals as fumes or oxides. Such fumes are drawn by a fan through a series of cooling-tubes and depositing-chambers, and pass lastly into a number of suspended woollen or fibrous bags, whence the deposit is shaken from time to time into smaller bags suspended below.

Ores consisting chiefly of lead sulphide, with zinc, antimony, silver, and gold are subjected in a state of fine division to a blast of highly-heated air, no flux being used. The fumes in such case consist chiefly of sulphates. Cupreous ores containing much silica are roasted with coal, or the like, and fluxes, in a cupola furnace. Copper is run off in the fluid state, the volatile metals being eliminated as fumes. The fumes obtained may be treated by lixiviation, or by acids, or in the dry way, to separate the components. Reference is made to Specification No. 687, A.D. 1879.

[*Drawing.*]

A.D. 1883, July 27.—No. 3679.

FRÈRE, Nestor.—Smelting and refining furnaces.

A reverberatory furnace formed with a grate is in communication with circular refining-furnaces, the hearths of which are at a lower level. These are heated by a portion of the hot gases from the smelting-furnace, which can be regulated by dampers. Sight and tapping holes are provided.

[*Drawing.*]

A.D. 1883, August 14.—No. 3933.

JUSTICE, Philip Middleton. — (*A communication from Francis J. Clamer.*)—Treating leads.

Lead is improved and rendered fit for coating metals by the process of dipping (like galvanizing) by melting it, and after sprinkling charcoal on the surface adding successively for every hundred pounds of lead three ounces of salammoniac, half an ounce of arsenic, one ounce of phosphorus, and half an ounce of borax, stirring between each addition. The improved metal may be run into ingots and used as solder. Tin, zinc, and other metals may be improved by the same means.

[*No Drawings.*]

A.D. 1883, August 16.—No. 3985.

McDOUGALL, Isaac Shimwell.—Furnaces for burning, calcining, or roasting sulphur ores, spent oxide of iron, etc.

Relates to apparatus for submitting materials to the action of air, as in roasting, calcining, and desulphurizing ores, or for submitting gas to the action of purifying-materials. It also relates to separating dust from air and gases such as sulphurous acid and coal gas.

Within a brick-lined casing are a number of floors built one above the other and having openings alternately in the centre and at the side. In the centre is a vertical shaft of cast iron with a wrought-iron lining and fitted with a hard steel bottom working on a loose steel disc which can be replaced when worn. The shaft is driven by any convenient gearing at the top. Rakes of cast iron strengthened with internal wrought-iron tubes have forked ends to embrace the vertical shaft, to which they are secured by cottars so that they can be taken off to allow of the removal of the shaft for repairs. The shaft passes freely through holes in the floors covered by plates where central passages are not required. The rakes have their teeth set angularly to move the material across the floor inwardly and outwardly alternately so that it may fall from floor to floor. At the upper part of the casing is a floor and rake for drying the material before passing it into the apparatus, which it leaves through a suitable outlet. There are feed hoppers at different levels. In another arrangement the

floors are placed horizontally side by side, and the rakes then pass the materials along the floors from one end to the other. Two or more superposed tiers may be used. Applied to a furnace this arrangement is suitable for desulphurizing pyrites and obtaining sulphurous acid, calcining spent iron oxide, and other purposes.

The dust is separated by passing the gas through a chamber containing perforated plates placed so that the perforations are not opposite. The solid parts of the partitions arrest the dust, which settles. Near the bottoms of the divisions there are no perforations, and dampers are fitted which can be set across them to shut off communication with the gas above while the dust beneath is withdrawn through doors in the side of the chamber.

[*Drawings.*]

A.D. 1883, August 16.—No. 3986.

LONGDEN, JOHN NEEDHAM, MORGAN, WILLIAM PRITCHARD, and STIRLING, ARCHIBALD WILLIAM.—(*Provisional protection only.*)—Amalgamating process for extracting gold and silver from their ores.

The ore is introduced to the bottom of the amalgamator by a rotating tube with distributors at the lower end, and to delay the ascent of the ore through the mercury, coils, bars, gratings, or curved plates of copper or electro-silver are interposed in its path. To quicken the mercury, sodium amalgam may be introduced in a constant or intermittent stream. The pan may be steam-jacketed. When dealing with mundic, sulphurets, &c., the mercury may be made the negative and the water the positive pole of an electric battery.

[*No Drawings.*]

A.D. 1883, August 17.—No. 4000.

LAKE, HENRY HARRIS.—(*A communication from Thomas Walker and John F. Carter.*)—Ore-roasting furnaces.

This furnace is designed to automatically, continuously, and rapidly de-sulphurize, oxidize, and chloridize prepared ores, and to generate sulphurous acid fumes from pyrites. In flues in the brickwork and over a fireplace are fixed two vertical rows of retorts with their ends projecting through the brickwork.

Within each retort is a hollow shaft carrying rakes secured by holes at each end to ears on clamps which embrace the shaft and are prevented from turning thereon by projections which take into recesses in the shaft. The flat teeth of the rakes are inclined so as to push the ore towards the end of the retort where it falls through an opening into the retort beneath, and so on through other openings into the lower retorts until it passes out by a suitable passage. The material is fed in from a hopper through an opening. Each pair of rakes has its teeth set so that those of one rake are opposite the spaces between those of the other. The holes for the ends of the shafts are rather larger than the shafts to allow of adjustment, and are covered by close-fitting sliding plates. Water is let into the top shaft from a pipe with a water joint and thence through pipes each having an expansion bend, and the lower shafts to a waste pipe. The shafts are driven by worm gearing. The fumes pass off through passages to settling-chambers. These passages are controlled by dampers operated by handles. The bearings for the shafts are placed between the gearing and retort at one end, and between that and the water pipe at the other. At the ends of the retorts are air holes guarded by doors which are held open by weights, or closed and kept so by pressing the weight up against a curved bar. By means of the air doors and passages air may be circulated up or down through the whole or part of the system of retorts. Above the furnace are partitions terminating at alternate ends near the furnace walls, and so causing the heated products of combustion to take a zig-zag course to the chimney. Fumes and dust arising in roasting and sulphurous acid preparing retorts pass along passages into settling-chambers in which the dust collects.

[*Drawings.*]

A.D. 1883, August 17.—No. 4002.

WOOD, James.—Grinding or reducing ores etc. and separating such ground substances.

For treating ores, quartz, phosphates, and the like, one or more heavy runners having very narrow peripheries are mounted so as to run loosely on a shaft above a revolving pan which contains the material. The narrow periphery concentrates the weight of each runner on a small surface of the

material. The bottom of the pan is made with perforations widening downwards to prevent clogging. The crushed material passes thence to a plate, and is directed by scrapers attached to the pan into a receptacle, whence it is transferred by an elevator to a pneumatic separating-apparatus, whence the coarser parts are returned to the pan by a shoot. The pneumatic separator is arranged as follows:—The material passes into a hopper and falls upon inclined shelves. The finer portions are drawn through an opening into a box by means of a current of air induced by a fan at the other end of the box. The box is divided by partitions, and is fitted with doors for removing the material. The coarse stuff passes back to the crusher through a shoot.

[*Drawing.*]

A.D. 1883, August 21.—No. 4057.

LAKE, HENRY HARRIS.—(*A communication from John Benbow Jones.*)—(*Provisional protection only.*)—An alloy chiefly designed for deoxidizing and coating metal plates.

An alloy, instead of tin, for coating iron plates is made of various proportions of tin, lead, and zinc with the addition of a little metallic sodium. The alloy is electropositive to the iron, and melts at a low temperature, so that vegetable or animal fats may be used to cover the surface when melting and dipping.

[*No Drawings.*]

A.D. 1883, August 28.—No. 4139.

ARTHUR, WILLIAM.—(*A communication from Joseph Pearson Gill.*)—Treatment of iron and steel for protecting and improving the quality of the same and in apparatus to be employed in the said treatment.

The invention consists in coating iron and steel articles by a process similar to the Barff process. The apparatus consists of a furnace employed to heat a muffle chamber containing a muffle for the articles to be coated, and another chamber above containing a superheater and a vaporizer, which communicate by pipes with the muffle. A current of superheated hydrogen is first used, and afterwards steam or air or carbonic acid to produce the surface oxidation; after which hydrocarbon or

mineral or nitrogenous oils are passed through the vaporizer and the vapour caused to act, alone or in conjunction with, or alternately with, steam, on the oxidized articles. Carbonic oxide, carburetted hydrogen, or carburetted air gas (produced, for example, as in the inventor's Specifications Nos. 916 and 4138, A.D. 1883) may be used instead of the oil vapours.

Regulating-apparatus for the supply of the hydrocarbon vapour is described and claimed. The action of nitrogen gas, whether the nitrogen in air gas or that resulting from the vaporization of the nitrogenous oils, is also claimed as improving the texture of iron (from fibrous to crystalline) and tempering steel, in addition to assisting in the coating process.

[*Drawing.*]

A.D. 1883, August 30.—No. 4186.

BELL, JOHN, and DAVIS, GEORGE JAMES.—(*Partly a communication from John Peter Kagenbusch.*)—(*Provisional protection only.*)—Separating and extracting metals from minerals, tailings, refuse, etc.

To extract "precious and other metals" from "hornblende, "syenite, asbestos, mica, serpentine, granite, silica and alumina "and all other minerals, tailings, and refuse from mines and "mineral dressings works, refuse from chemical works," &c. the minerals are roasted with rock salt and carbon, the roasted material being pulverized, and fused with carbonate of soda or carbonate of potash; lime, fluorspar salt, or other fluxes may be added. The metals are separated from the dross by crushing and washing, and again melted with carbonate of potash and carbon; copper and zinc and a little carbonate or oxide of lead are added to the melted materials, and the resulting metallic alloy is run into bars, from which the precious metals can be separated by refining processes. The slag from the alloy can be smelted with fluxes and carbon to form alloys of the metals contained in it.

[*No Drawings.*]

A.D. 1883, September 4.—No. 4248.

NEWTON, HENRY EDWARD.—(*A communication from Thomas Egleston.*)—Crucibles, muffles, etc. for melting, reducing, or distilling metals.

The interior surface, which is essentially basic, may be made of baryta, strontia, lime, magnesia, alumina, carbon, or of any two or more of these elements. The exterior surface may be made of acid refractory material, such as the silicates of the above elements, or of the elements themselves. Or it may be made of a combination of silicates and bases. Both the exterior surfaces may be of basic material, but of different constitution.

[*Drawing.*]

A.D. 1883, September 7.—No. 4303.

SHOLL, Charles.—Pneumatic hammers or stamp mills for crushing ores etc.

Reference is made to Specification No. 2524, A.D. 1875. The pneumatic cylinder and stamp are each preferably made separate, the two being united by flanges and bolts. The cylinder is made in sections united by flanges and bolts; its top is cast in one piece with its body, and it also has a lining of any non-conducting metallic alloy, and made in one piece or in two flanged and bolted pieces. The cylinder has two longitudinal slots to admit cushioning air, and of such length and so arranged that the air above or below the piston becomes compressed towards the completion of each stroke. Upon a horizontal pin is pivoted a pneumatic piston having rings of metallic alloy, reciprocated by a bifurcated rod or by two rods coupled at one end to the pin and at the other with the crank of the driving-shaft. To keep the cylinder cool and moisten the ore etc. to be crushed, a circular perforated pipe with two perforated branch pipes is arranged in the apparatus. Instead of the air cushion a buffer spring may be fixed to the top of the piston, so that as it approaches the top of its stroke it compresses the said spring. A similar spring may be fitted to the bottom of the piston. In a modification, the cylinder and stamp have a vertical central tube through which the ore is fed from a hopper so that it falls through the centre of an annular shoe or the stamp into a coffer.

[*Drawing.*]

A.D. 1883, September 12.—No. 4369.

REEVES, Thomas.—(*Provisional protection only.*)—Decorating metal articles with enamel.

A method of producing enamelled metal articles of jewellery at a low cost. The articles are made of Webster's patent metal of bismuth bronze, which is an alloy of bismuth, tin, copper, zinc, and nickel ; on the parts to which the enamel is to be applied gold, silver, or other suitable metal is deposited by electricity. The enamel is then applied to the plated surface and the articles are subjected to a red heat.

[*No Drawings.*]

A.D. 1883, September 13.—No. 4379.

IMRAY, JOHN.—(*A communication from Henri Rémaury and Ferdinand Valton.*)—Material for lining furnaces and metallurgic vessels etc.

Chromic iron is pulverized to the condition of coarse sand, and is mixed, in slightly-heated pans, with a certain proportion of the carbon deposit of gas retorts, and tar, pitch, or heavy oil. The compound may be applied directly as a lining by ramming it in place with heated rammers, or it may be formed into bricks by ramming it into iron moulds and raising it to a red heat in a furnace.

[*No Drawings.*]

A.D. 1883, September 18.—No. 4445.

COOK, THOMAS.—Revolving furnaces.

Rotary furnaces for treating carbonate of soda and sulphate of magnesia, carbonizing, roasting ores, and for other purposes. Bearing rings are cast in steel in one piece with the tyres and webs of the furnace, thus securing equal expansion throughout. The tyre and ring may be connected by a single web and the whole may be made in segments. The tyres may be trued up in a lathe.

[*Drawing.*]

A. D. 1883, September 25.—No. 4574.

BOTT, JOSEPH ELTON. — (*Letters Patent void for want of final Specification.*)—Crucibles for melting or refining or converting metals etc.

Crucibles are formed with an outer casing of iron and an inner lining of refractory material, and are of a rectangular form when for use in a gas furnace, and oval when they are to be heated by gas direct from the producer.

[*No Drawings.*]

A.D. 1883, October 4.—No. 4713.

JUSTICE, PHILIP MIDDLETON.—(*A communication from the Frue Vanning Machine Co.*).—Concentrating and vanning apparatus.

Relates to apparatus for treating crushed or fine minerals or ores to separate the lighter particles by washing. A shaking frame is supported by a series of flexible straps adjustably secured to a stationary frame by bolts and slotted blocks having curved projections. Rollers are mounted in adjustable bearings in the shaking frame, and around them passes an endless belt having raised edges or flanges ; this belt is further supported by intermediate rollers and is tightened by lower rollers mounted in brackets secured to the frame. Lateral motion is imparted to the shaking frame from a shaft through a crank and connecting-rod, and the endless belt is actuated by imparting rotary motion to one of its supporting-rollers through a belt and worm gear etc. arranged to allow for lateral motion. An arrangement is provided so that the travel of the belt may be immediately stopped. The material is fed on to the travelling belt from a box, and is carried beneath a series of water jets which separate the sand and lighter particles, the heavier particles being carried forward into the concentrating or collecting boxes.

[*Drawing.*]

A.D. 1883, October 6.—No. 4758.

BEVERIDGE, JAMES.—"Treatment of ores or other sub-"stances containing antimony by the wet process."

The powdered ores, containing preferably a stated proportion of antimony sulphide, are treated with strong hydrochloric acid in earthenware pots enclosed within cast-iron pots, the interval being packed with sodium silicate and asbestos, or cement, or iron filings and ammonium chloride. The pots may

be set over fireplaces, or the ore may be digested in the steam-jacket pans described in Specification No. 5809, A.D. 1882. The vessels may also be heated by an oil or calcium-chloride bath ; or steam may be injected into the mass. The digesters are provided with covers, each with a pipe for passage of the hydrogen sulphide liberated, which is taken to a square flag-stone tower packed with wood prisms, down which dilute acid liquors from the after processes are showered.

The antimony-chloride solution is drawn from the pots into a stone settler, whence the cleared liquor is taken to a second stone or wood vessel, in which it is largely diluted ; steam is then injected until a precipitate of antimony oxychloride separates. The process is repeated on fresh portions of liquor until the precipitate is sufficiently accumulated. The dilute hydrochloric acid constituting the liquor, and still containing some antimony, is partly used in washing the digested ore, and partly, together with the second washings of the ore, in the towers before described, where it absorbs hydrogen sulphide, and is then run into a wooden tank in which is a large perforated ebonite pipe through which air is blown. The weak acid is then filtered off the precipitated antimony sulphide on coarse woollen cloth stretched over the sides and bottom of a wooden tank. The drained sulphide is fused with flux in crucibles to obtain the black sulphide. The dilute acid recovered in this process, after treatment with a little bleaching-powder, is used instead of water in alkali works to condense hydrochloric-acid gas.

Antimonious oxide is prepared from the oxychloride by boiling the latter in sodium-carbonate solution, and washing by decantation. Or the oxychloride is strongly heated with carbon, sodium chloride, and sodium carbonate to obtain metallic antimony.

[*No Drawings.*]

A.D. 1883, October 10.—No. 4818.

CLAUDET, Frederic.—Treatment of copper mattes in order to obtain the silver and gold therefrom.

The mattes are finely ground and roasted until the sulphur is expelled and oxidation effected. If necessary the product is again ground and roasted. The powdered and

roasted ore is then gradually introduced to a stone vessel like a chlorine generator, supplied with a mechanical agitator and partially filled with hydrochloric acid of stated density. The heat is kept up to about 109° F. by injection of hot air or steam, or by other means. When solution is effected, and after subsidence, the clear liquor is run into the des-ilverizing tanks. More acid and calcined matte are put into the digester, and the process is repeated until sufficient deposit is accumulated. The latter is then treated with acid, and the acid solution obtained utilized in treating a fresh portion of roasted ore. The exhausted deposit is reserved to be smelted for silver or gold, or to be roasted with fresh ore, according to its composition. Sometimes the residues are re-roasted before being successively treated with acid.

The nearly-saturated copper-chloride solutions are run into tanks of known capacity, and a sample is assayed for silver as directed in Specification No. 282, A.D. 1870. A soluble iodide in proper proportion is then added to the liquors with agitation, and after subsidence the clear copper liquor is run off to be precipitated by iron or otherwise treated; and the silver iodide (possibly with some gold) is collected, washed with hydrochloric acid and water, and then decomposed by iron or zinc, or by an alkaline sulphide. The iron or zinc iodide obtained (when iron or zinc is used) may be used in a future operation.

[*No Drawings.*]

A.D. 1883, October 10.—No. 4829.

SHEDLOCK, James John.—(*Provisional protection only.*)—Separating metals from their alloys and compounds.

The alloy, in plate form, is made the anode of an electric current and suspended in a suitable liquid, " acid or alkaline or containing the salts or oxides of metals," according to the alloy to be treated, contained in a porous pot placed in an outer vessel, filled also with solution, and containing metallic plates for cathodes. The dissolving cells may be combined in series. The solution flows from a tank into the outer vessels, thence into the inner, and thence is withdrawn through the bottom to a depositing-tank divided into compartments by porous partitions according to the number of metals to be deposited. Anodes and cathodes of different metals are suspended in

these compartments, and the solution as it flows from one to another has different metals deposited from it according to the composition of the immersed plates. The alloy contained in the dissolving cell will have its more oxidizable metals dissolved out of it, and the remainder will be deposited as a powder at the bottom of the cells. Steam or hot water may be used to heat the vessels.

[*No Drawings.*]

A.D. 1883, October 11.—No. 4851.

PRICE, Astley Paston.—Extraction of the precious metals from their ores etc.

Copper ores or pyrites, mattes, or other compounds containing gold or silver, or both, are calcined, sometimes with salt or other chloride, and the product is treated with hydrochloric or other acid. The solution obtained, after being entirely or partially neutralized, is agitated with finely-divided or precipitated copper, either by mechanical means or by injection of air or steam. The precipitate, containing any gold and silver present in the materials treated, is separated and worked for recovery of those metals in any known way.

An alternative process consists in treating the described solution with hydrogen sulphide, or a soluble sulphide, such as sodium sulphide, or with an insoluble metallic sulphide, such as copper sulphide, the liquor being agitated as in the preceding process. The precipitate, containing sulphide of precious metals, is collected and suitably treated for recovery of these.

Copper may be obtained by known means from the residual solutions. The residue left undissolved in the acid treatment are calcined, and again digested with acid.

[*No Drawings.*]

A.D. 1883, October 16.—No. 4930.

GADSDEN, Henry Arthur.—(*A communication from Emerson Foote.*)—Obtaining aluminium from its ores.

The invention is described as an improvement on that given in Specification No. 1995, A.D. 1883. Aluminous material, such as aluminium, corundum, or bauxite, is calcined, ground, and mixed with stated proportions of sodium chloride and

carbonaceous matter, for which latter starch or oil and charcoal are preferred. The mixture is brought to a paste with water, made into balls, and dried. The balls are then heated in a suitable retort through which chlorine is passed, and the double chloride distills over into a chamber. Sodium vapour also enters this chamber through a second tube, it being generated by heating sodium carbonate, and charcoal or similar materials, in another retort. The vapours of sodium and of the double chloride re-act to form metallic aluminium, which falls to the bottom and collects in the form of globules, and sodium chloride.

[*Drawing.*]

A.D. 1883, October 23.—No. 5033.

CLEAVER, Edward Lawrence.—Recovering tin from tin scrap.

The cleaned tin plate scrap is boiled in an acid (hydrochloric) or alkaline (caustic potash or soda) bath until the tin is dissolved. The solution is electrolysed, and the deposited tin cast into ingots. Or the tin may be dissolved off the scrap by electrical action, and deposited on a metal electrode. If a salt of lead is added to the tin solution, an alloy of tin and lead will be deposited, forming solder. Other alloys may be prepared by adding other metallic salts. Other acids and alkalies may be used to dissolve the tin.

[*No Drawings.*]

A.D. 1883, October 27.—No. 5104.

LAWRENCE, Henry, and RYOTT, Joseph Lamdin.—(*Provisional protection only.*)—Metallic compound for ramming or tamping gunpowder etc.

Relates to an alloy for ramming gunpowder, or for the wheels of locomotives and other vehicles in coal mines etc. to prevent sparks being formed. It consists of metals melted together in or about the following proportions :—$76\frac{4}{21}$ parts of copper, $14\frac{2}{7}$ of lead, $4\frac{16}{21}$ of antimony, and $4\frac{16}{21}$ of bismuth.

[*No Drawings.*]

A.D. 1883, October 29.—No. 5125.

PRICE, Astley Paston.—Wet process of gold and silver extraction.

A solution containing the precious metals is obtained from the ore by known processes, such as roasting, calcination with salt, and treatment with water, salt solution, or acids ; roasting and treatment with sulphuric, nitric, or hydrochloric acid or aqua regia, &c. To the solution, partly or completely neutralized zinc or other metal (except copper) capable of precipitating gold and silver is added in powder, and after agitation by steam, air, or mechanical means, the excess of precipitant is allowed to subside together with the reduced metal, and the supernatant liquid removed by decantation or filtration. Any copper left in solution may be extracted by known means.

[*No Drawings.*]

A.D. 1883, October 30.—No. 5147.

HARRIES, Thomas Davies.—(*Provisional protection only.*)—Preventing the pollution of rivers.

Relates to the prevention of polution of rivers by water from mines, or water used in dressing ores, tanning, etc., by using the same water over and over again. For example, in a mine there are three tanks provided, two above the dressing-floor level and one below. After a day's work the water is pumped from the lower tank to one of the upper ones and allowed to rest during the night. The next day it is drawn off clear and used again. The other upper tank is a reserve tank.

[*Drawing.*]

A.D. 1883, November 3.—No. 5227.

VON NEUENDAHL, Leo.—(*Complete Specification but no Letters Patent.*)—Treating zinc ores etc. in blast furnaces for extracting zinc and lead, and furnaces therefor.

A specially-arranged blast furnace and process for extracting zinc and lead from very poor ores, also plumbiferous zinc ores, plumbiferous and zinciferous iron ores, zinciferous waste of iron furnaces, zinciferous and plumbiferous slag and refuse from desilverizing processes, zinc dust from roasting-furnaces with

binding-material in the form of briquettes, etc. The materials are mixed with coal etc. and fed into the top of blast furnaces through two hoppers with an intermediate chamber and two slides or dampers so as to exclude air from the furnace while charging. Reducing-gases from a generator are conducted by a flue to the furnace foundation, and thence by vertical pipes into a ring space, from which tuyères conduct them into the furnace. The walls of the gas canals and flues are made of refractory gneiss, the furnace lining of firebrick, and the tuyères connecting the two are lined with neutral graphite bricks. Cold, hot, or compressed air may, by separate ports, be forced through the same tuyère at will. The hot gases and vaporized zinc are led off from the upper part of the furnace through four flues inclined downwards through the lining, and thence up through vertical flues with an annular chamber above, from which they pass by two large descending flues on opposite sides into an annular chamber surrounding the lower part of the furnace, and thence into the trapped fume-condensing flue, and thence to the chimney. An exhaust or pump may be used. The flues and channels have dust pockets with bottom doors at intervals for removal of the condensed zinc fume. The sole of the furnace is inclined and channelled to run off melted lead, and opens into four clearing-chambers in the sides of the furnace. A transverse air space is made beneath the furnace sole to keep it off the ground and facilitate recovery of lead from the same.

[*Drawings.*]

A.D. 1883, November 5.—No. 5234.

FOX, SAMUEL.—Annealing wire and metal in other forms.

Annealing-furnace for wire, metals, etc. The furnace has a hot chamber and a cooling-chamber separated by a partition, the flame and furnace gases ascending in the former and descending in the latter. In each chamber is a cylindrical vessel supported on a turntable, let into the floor of the furnace and rotated from below. Within these vessels are cases which can be lifted out by removing the covers. The coils of wire to be annealed are placed in the cases with a dummy cylin- in the centre, or an inner case for smaller coils may be substituted. After a time the case in the cooling-chamber is removed into the air to cool, that in the hot chamber being

put in its place, and a fresh case is placed in the former chamber. In a modification, a single chamber contains three cases for small wire coils, and each of these is rotated independently from a central shaft within the hollow shaft which rotates the chamber.

[*Drawing.*]

A.D. 1883, November 5.—No. 5235.

JORDAN, THOMAS ROWLAND.—Treating ores for the extraction of precious metal.

The amalgamator is cylindrical, with a conical bottom, and is steam-jacketed.

It carries a revolving central tube provided with a hopper for the introduction of ore, and surrounded by a drum with radial arms or beaters at different heights to delay the particles of ore in their upward passage through the mercury. Screwed on to the bottom of the feed tube, which may be an inverted cone, is an injector consisting of a hollow disc with curved radial passages, acting on the reaction principle, for introducing the powdered ore into the mercury. The revolving vanes can be set at different angles and so retard the passage of the ore to different degrees, and the drum carrying them is rotated in an opposite direction to that of the feed tube.

The tailings on arriving at the surface of the mercury are blown through an exit pipe across the top of a series of sorting-chambers, the heaviest particles falling into the nearest chamber, and so forth. Another amalgamator consists of a horizontal tube clothed on the inside surface with copper pegs and carrying a helical rotating brush of the same diameter as the tube. The tube is filled with mercury and the ore or tailings fed through a hopper at one end ; at the other end is a tank with conical bottom into which the heavy amalgam falls, a small return tube being provided for the circulation of the greater portions of the mercury.

[*Drawing.*]

A.D. 1883, November 5.—No. 5236

JORDAN, THOMAS ROWLAND, and LONGDEN, JOHN NEEDHAM.—Extracting metals from their ores.

Treating gold and silver ores and tailings. The process consists of a series of operations comprising crushing, pulverizing, sorting, amalgamating, and treating the tailings, in which air is used instead of water for conveying the ore through the different apparatus and for sorting or separating it. From a stone-breaker the ore falls down a chute into a Jordan's Patent or other pulverizer, from which it is delivered by an air current from a blower or other source into a concentrating-chamber, in which the air current separates it into different degrees of fineness, specific gravity, and value. Each grade is passed by a screw or other conveyer to a chute through which it passes to a Jordan's or other amalgamator at a lower level. A blast of air passing over the surface of the mercury conveys the tailings to a concentrator in which they are separated by the air into different grades and the waste material blown away. Reference is made to a previous Specification No. 5235, A.D. 1883.

[*Drawing.*]

A.D. 1883, November 13.—No. 5355.

MILLS, Benjamin Joseph Barnard.—(*A communication from Pierre Manhès.*).—Treating sulphurous and arsenical ores of nickel, cobalt, and other metals.

The ores are separated from their gangue by fusion, and the matte obtained is concentrated in a converter until it contains only 1 to 2 per cent. of iron and from 15 to 20 per cent. of sulphur and arsenic. This matter is attachable by hydrochloric acid, and the metals may be extracted by known wet processes. It is also a conductor of electricity and adapted for electrolytic separation. An alloy of the metals contained in the matte is obtained by re-melting it, and passing it into the converter, the refining being completed by a fusion in presence of excess of carbon and of lime. Rich alloys nearly free from sulphur may be treated in the same way.

[*No Drawings.*]

A.D. 1883, November 16.—No. 5407.

PRICE, Astley Paston.—Obtaining copper from cupreous solutions.

Solutions containing copper, such as mine waters, or results of the lixiviation of treated copper ores, are precipitated after

neutralizing, if necessary, by finely-divided zinc, such as "zinc fume," steam or air being injected, or the solution otherwise agitated. The precipitated copper is collected and brought into the state of cake copper, if desired. The cleared solution is used to dissolve soluble copper salts, the copper being precipitated as before. The solution is then precipitated by lime to obtain zinc oxide, from which "zinc-fume" may be obtained for use.

[*No Drawings.*]

A.D. 1883, November 16.—No. 5416.

PRICE, Astley Paston.—Manufacture of zinc.

Zinc is extracted from its ores or other compounds or metallurgical products by smelting them with suitable fluxes and reducing-materials in a cupola, blast, or other furnace so constructed that the products of combustion, together with the vaporized zinc, are conducted through a condenser or scrubber, when the zinc is condensed by means of steam or water. The zinc is afterwards mixed with carbon and distilled, or pressed and melted.

[*No Drawings.*]

A.D. 1883, November 19.—No. 5452.

SMYTH, Samuel Richard.—(*Provisional protection only.*)—Smelting ores and apparatus therefor.

The inventor terms his process a "liquid process" for smelting iron and steel and other ores and metals. It consists in supplying the blast furnace with "liquid hydrocarbon and "liquid oxyhydro compounds, also liquid alkali compounds by "first accumulating and afterwards atomizing and distributing "the same either by hot or cold air blast." Atomized water or vapour, or superheated steam, or carburetted hydrogen, or carbonic oxide, or oxygen, or hydrogen are also used alone or combined. If a liquid is used it is stored in a tank with such a head as to overcome the pressure of the air blast as it enters the tuyères. Oxygen and hydrogen are stored in holders and forced in at the tuyère end of the descending blast pipes. The liquid-supply pipes are branched and valved, and atomizers are attached to the mixing-boxes which are placed in the blast

pipes. A drop valve fitted to main blast pipe allows escape of accumulated gases when blast is shut off. Steam is used superheated or "decomposed in a furnace." "Fluxing compounds" are generated by these materials in the furnace itself.

[*No Drawings.*]

A.D. 1883, November 20.—No. 5457.

WALKER, James Graham.—Washing grain etc.

Describes apparatus for washing and drying grain to remove the outer rind or husk. Below a hopper is a water-cistern provided with an inclined division, over the top of which a continuous stream of water flows and mixes with the grain as it falls from the shoot of the hopper.

The heavy matters fall down the division to the bottom of the water-cistern.

[*Drawing.*]

A.D. 1883, November 22.—No. 5489.

FAURE, Camille Alphonse.—Means and apparatus for the treatment of alkaline salts at high temperatures, applicable also to other uses.

An improvement on the inventor's previous Specification, No. 6058, A.D. 1882, for obtaining sodium, potassium, etc. by a pyro-electric process from alkaline salts.

The mixture to be reduced, such as carbonate of soda and fine carbon, is heated in a reverberatory-chamber or furnace made of compressed magnesia or lime, or the same materials melted with slabs by an electric furnace. Embedded in the sole of the furnace, or disposed in bars flush with the sole, or in sinuous lines separated by corrugations, are a series of conductors heated intensely by the passage of an electric current. The sodium vapour escapes through a side opening into an ordinary sodium condenser. Sometimes a stream of hydrocarbon gas is introduced to help the reaction.

To provide a refractory substance for furnaces and retorts, the mixture of carbonate of soda and charcoal is subjected to preliminary heating in retorts or cylinders of compressed magnesia or lime, or of the same materials melted by pyro-electric means. The furnace is constructed of the same material.

[*Drawing.*]

A.D. 1883, November 28.—No. 5564.

CLARK, Alexander Melville.—(*A communication from J. B. Thiéblemont.*)—Process and apparatus for the reduction of iron and other ores.

Relates to a process, furnaces, and apparatus, for the direct reduction of ores of iron (and other metals such as nickel, copper, zinc, etc.) without passing through the stage of pigs or mattes. The process is described with special reference to iron and steel. Gaseous fuel from a gas producer is used as the reducing-agent, two or more producers being used so that one is generating gas while the other is being heated. The process may be combined with gas manufacture by distilling off the gas from ordinary coal in the producer for other purposes and using the residual coke *in situ* to generate the producer gas.

The producer gas passes first through the fore-hearth of a melting or refining furnace, thence into the heated chamber of a regenerator beneath the cupola furnace, and thence up through the body of the cupola or reducing furnace, meeting the descending pulverized and coated ore (mixed or not with carbonaceous matter) which it reduces to a mass of spongy or finely-divided iron. On the top of the reducing-furnace is mounted the ore drier and calciner, heated by a portion of the escaping gases which become ignited in the calciner and pass out into the air. The other portion of the gases pass down through a flue at the side of the furnace into the cooled chamber of the regenerator, the direction of the gases through the two regenerator chambers being reversed periodically by the usual valves. It is stated that the gaseous reducing-agents do not reduce the phosphorus and silicon compounds in the ore, and hence the process is adapted to deal with phosphatic iron ores.

The iron sponge cools in a receptacle beneath the furnace and (after being pressed or not in an intermediate chamber traversed by the current of reducing-gas) is melted in a reverberatory refining-furnace divided by a partition extending part way down from the roof into a main hearth and a fore-hearth. The latter, into which the iron is fed, is heated by reducing-gas; the former, in which it is worked or refined, by currents of air and gas entering through side-holes. A bath of fused silicate is kept in the refining-furnace to purify the iron.

[*Drawings.*]

A.D. 1883, December 8.—No. 5677.

SIEMENS, Frederick.—Gas furnaces.

Regenerative gas furnaces are constructed so that the flame is made to move through without contact with the objects to be heated or with the roof and walls, and to act chiefly or entirely by radiation.

The invention is applicable to annealing or reheating furnaces. The gas flues and flues at each end of the furnace are side by side, the gas flues being inside, and the flame passes across above the working doors and below the roof.

[*Drawings.*]

A.D. 1883, December 8.—No. 5679.

JORDAN, Thomas Rowland.—(*Provisional protection only.*) —Crushing or pulverizing minerals etc.

Relates to improvements in apparatus described in Specification No. 4951, A.D. 1879. A ring of hard steel etc. is fixed to the outer extremities of the arms of each of the beaters, and to prevent the crushed material from passing between the rings they are partially surrounded by pieces of metal fixed between the two castings forming the crushing-chamber; any material that does so pass escapes through an outlet in the bottom of the chamber. The material is fed to near the centre of the chamber, and the product is delivered through a pipe leading from the upper part of the chamber by a current of air produced by fans etc. fixed to the beaters. In the delivery pipe, below the hopper, is placed a tray having an aperture at its front end and reciprocated by a cam.

[*No Drawings.*]

A.D. 1883, December 10.—No. 5690.

LAKE, Henry Harris.—(*A communication from Edward B. Meatyard.*)—Toggle presses for ingots etc.

To the upper and lower beams of the press frame are fitted the bedpieces, the whole being secured by rods with nuts, which are enclosed in cylinders. The beams extend across the machines and are arranged near the outside of the frame. The frame consists of channel beams, and in the space between the

channel beams are arranged upper and lower blocks provided with flanges. The actuating toggle arms are pivoted at their outer ends respectively to these blocks, and are bifurcated at their inner ends. Knuckles are arranged on a right and left hand screw, and a worm-wheel is centrally connected to the screw shaft. A worm shaft receiving its motion from a pulley is held to the worm-wheel by a strap, its outer end being connected by a link rod to the worm shaft. Each press is provided with a press toggle composed of a toggle block and upper and lower arms pivoted respectively to the head piece of the press and followers; the toggle blocks being connected by guide toggle arms to the guide blocks. The followers are connected together by beams which are arranged one on each side of the presses, and upright bars are attached to the inside of the beams and are connected at both ends by cross-bars. A series of moulds for pressing and purifying metal ingots are arranged in each press in nests, and in the rim of each mould on each side of the inlet short dovetail grooves are connected which extend down a short distance. For pouring the metal a main gate is provided which has dovetail projections on one side adapted to fit the grooves in the mould. The gate has branch gates which serve as inlets to the moulds, and the joints between the moulds are stopped by a cord of asbestos etc. which may be held in place by coal tar etc. The moulds are connected together and to their respective followers by links.

[*Drawing.*]

A.D. 1883, December 15.—No. 5751.

THOMPSON, William Henry. — Crushing, grinding, and amalgamating mineral and other substances.

Relates to a pulverizer or mixer, combined with screens, for mineral, animal, and vegetable substances. The bevel-wheels, which impel a ball resting upon them, are fitted to work with, and capable of rocking on, clutches fixed upon a square portion of the shaft upon which they are mounted, whilst nuts keep the clutches in position. Frames carry screens for regulating the fineness of the pulp or pulverized substance passing away from the mill. In the centre of each of the frames is a ring fitted with a chamber, and having a stuffing-box at the back

of which is an annular water space or chamber, with sufficient clearance on one side to form a circular jet through which the feedwater flows from supply pipes for wet grinding or pulverization ; the flowing water keeps the bearing surfaces free from grit and prevents it from passing to the stuffing-box. The stuffing-boxes may be omitted, the chambers form around the shaft a circular jet through which the feedwater is directed. When used for dry grinding &c., instead of water, a current of air is employed acting in a similar manner. In a modification, propelling-blades are arranged on discs and serve to draw the substances from the ball into two chambers, one of which is fitted on each side of the mill, and serves to admit of the working of the shaft, and suitable channels through which the substance drawn from the mill is returned to it through a hopper ; the material being drawn off from channels.

[*Drawing.*]

A.D. 1883, December 15.—No. 5756.

DE OVERBECK, Gustavus, Baron.—(*A communicatiom from Hermann Niewerth.*)—Production of aluminium.

Relates to obtaining aluminium by electrolysis. The electric current is passed between electrodes suspended in a solution of the aluminium salt of an organic acid, such as aluminium acetate, or an equivalent mixture of salts may be used, such as aluminium sulphate with sufficient sodium acetate to furnish acetic acid equivalent to the alumina present. Instead of an organic salt aluminium sulphate may be used with sodium chloride or other metallic chloride in sufficient proportion to supply chlorium equivalent to the aluminium present.

[*No Drawings.*]

A.D. 1883, December 18.—No. 5788.

LAKE, William Robert.—(*A communication from Cummings Cherry.*)—Methods and apparatus for treating ores to purify and prepare them for smelting.

Ores of iron, gold, silver, copper, or lead are calcined, roasted, and prepared for smelting in a vertical retort furnace of special construction.

The retort has an extension at the top, with luted removable cover and an escape pipe provided with a safety-valve by which

the pressure inside the retort can be regulated ; the end of this escape pipe is coiled in a condenser. The retort is heated by a furnace underneath, the gases passing by an annular flue up the outside of the retort, and down by an internal flue through the centre of the retort to a chamber containing air and steam superheated, the flues and chamber being packed with regenerative brickwork. The chamber has an extra furnace and is additionally heated by a pipe from an outside blast furnace. A perforated coil of pipe is introduced into the retort near the bottom, and the bottom itself is perforated. The retort can be put into communication with a chamber underneath when required by a sliding rod withdrawing a portion of the bottom plate. The ore being heated to 700°–1000° F. by the furnace gases, is treated with superheated steam at a pressure of not less than 30 lbs., admitted either through the coil or perforated bottom. When the phosphorus, arsenic, sulphur, etc. are eliminated, the steam is replaced by heated air at a pressure of not less than 10 lbs. until reoxidation occurs. The sliding door is then withdrawn and the ore falls on to an inclined grating forming the floor of the chamber beneath the retort ; the small pieces pass through the grating and the larger ones are removed from the chamber by a side door. Chlorine gas can be introduced into the retort and ores chlorinated therein.

[*Drawing.*]

A.D. 1883, December 18.—No. 5798.

WILDING, SAMUEL PEARCE.—(*A communication from Ludwig Grabau.*) — (*Provisional protection only.*) — Manufacture of aluminium and aluminium alloys.

Phosphor-aluminium is first prepared by melting aluminium with phosphorus or with compounds of phosphorus in conjunction with reducing-agents. The phosphor aluminium is crushed, mixed with alumina or argillaceous earth, and heated to incandescence in a crucible under a layer of coal powder, when the phosphorus reduces the alumina or clay and the reduced aluminium unites with that originally placed in the crucible. After cooling, the metal is separated from the slag and re-melted with a suitable flux.

To obtain alloys of aluminium with copper, silver, etc., phosphor copper or phosphor silver is used instead of the phosphor

aluminium. The alloy thus obtained may be united with phosphorus, and the phosphor metal used to increase the percentage of aluminium in the alloy by a second fusion with clay or alumina. Instead of phosphor metals, the analogous carbon or manganese compounds may be used, and the fluor-compounds of aluminium may be substituted for clay or alumina.

[*No Drawings.*]

A.D. 1883, December 22.—No. 5846.

MUMFORD, Thomas William Bassett, and MOODIE, Robert.—Grinding, crushing, or reducing ores, quartz, etc.

Relates to crushing-apparatus for ores and the like, combined with sifting and sorting apparatus. Any number of pairs of rollers are arranged in the machine. The rollers of each pair may revolve at the same or different rates, and each is provided with a brush pressed against it by a spring to keep it clean. The material passes from feed hoppers over inclined plates, fitted with guides to distribute it evenly between the rollers. After passing through the rollers it is taken by elevators, consisting of a chain of buckets, to the sifting and sorting apparatus, whence some passes back to the rolls from whence it came. Some is passed to the next pair, and the finest passes into suitable receptacles through shoots which may be fitted with automatically-closing doors. The material before passing to the first pair of rollers goes through a sieve which removes pieces of old iron etc., and the Provisional Specification states that an emery-wheel travelling on its axis may be arranged above the rollers to keep them smooth.

The sifting and sorting apparatus consists in one form of receptacles in which are two sieves, one above the other, supported by spring plates. The upper sieve is the coarser. The lower part of the receptacle is divided into three compartments by partitions, each compartment being connected with a separate shoot. The upper part of the middle partition is hinged and may be adjusted so as to send the coarse parts from the two sieves into certain compartments, or so as to send all into either of the two compartments. The sieves are worked by tappets giving an up-and-down shaking motion or by eccentric rods giving a horizontal motion and combined with spring buffers against which the sieves knock at

every stroke. Two rotating concentric cylindrical sieves may be used instead of the above. The material is brought by an elevator from the roller mill, part of the material being returned to be re-ground.

[*Drawings.*]

A.D. 1883, December 22.—No. 5847.

PRICE, ASTLEY PASTON.—Obtaining tin from tinned metallic surfaces.

The tinned metal is constituted "a terminal of a galvanic "or electric battery," in a solution of caustic alkali, such as caustic soda, when, on passing the current, tin is dissolved and deposited on the other terminal, which is a "plate of suitable "material or substance;" or the tin may form a sodium stannate or other stannate.

[*No Drawings.*]

A.D. 1883, December 28.—No. 5894.

IMRAY, JOHN.—(*A communication from Hermann Egells.*)—Constructing vessels or apparatus for resisting corrosive action.

For chemical vessels etc. which are now constructed of sheet lead, the inventor substitutes sheets of a stiff alloy of lead and antimony, like type metal, to which a little copper may be added, thin sheets being covered with a layer of pure 10-ft. lead on the inside by autogenuous fusion with the blowpipe.

[*No Drawings.*]

A.D. 1883, December 29.—No. 5914.

DICK, GEORGE ALEXANDER.—Metallic alloys or compounds.

Alloys of copper, zinc, and iron with phosphorus or manganese or both. Either phosphuret of iron or ferro-manganese (spiegeleisen) is dissolved to saturation in molten zinc at as high a temperature as possible without volatilizing the zinc. The composition thus formed is added to molten copper to form alloys therewith. If the ferromanganese contains more than half per cent. of silicon, more zinc than usual is used.

[*No Drawings.*]

A.D. 1883, December 31.—No. 5938.

MOREWOOD, EDWARD.—Making tin and terne plates, an apparatus therefor.

The plates on emerging from the pot (*see* inventor's previous Specification No. 365, A.D. 1878) pass between washing-rollers revolving in a trough containing clean coating-metal (*see* inventor's previous Specifications No. 3126, A.D. 1873, and No. 1696, A.D. 1876). The washing-rollers may have collars at their ends to prevent close contact, their surfaces may be grooved to take up molten metal and apply the same to the surfaces of the plates, and their surfaces may move at a higher speed than the plates. The trough is double and has between its legs a chamber full of grease supplied independently of the grease above the washing-rollers, so that the plates do not come into contact with air. After the washing-rollers, the plates pass through one or two pairs of improving or finishing rollers pressed together by springs ; the guides move in oblique slots, so that the rollers are eased a little as the plates are nipped ; a weak counteracting spring between the rollers also facilitates the passage of plates and lessens the jar. If one pair of finishing-rollers is used they are of small diameter, and each has a larger roller on its outside (so that these are four abreast). For the washing - rollers may be substituted endless bands carried on two pairs of wheels, or other surfaces.

[*Drawing.*]

A.D. 1883, December 31.—No. 5983.

WILLIAMS, JOSEPH STOKES.—Generation, utilization, etc. of electricity.

Improvements in, and in the application of, the inventions described in the following Specifications—viz., Nos. 700, 766, 856, 1174, 1556, 2558, and 4034, A.D. 1882, and Nos. 24, 2147, 5709, and 5110, A.D. 1883. Relates to the combination of thermo-electric batteries with apparatus for the production of illuminating-gas, heating-gas, or paraffin oil, for the reduction of metallic ores, or for the separation of metals, for the manufacture of glass, iron, or steel, for decomposing, evaporating, or chemical processes, for heating, working, or refining metals or other substances, for burning or glazing bricks, pottery, and

the like, and for heating steam generators and calcining-furnaces. The electricity so generated is to be utilized for lighting, heating, motive power, electrolysis, and other purposes. The Specification also describes a system of electrical distribution for supplying the electric current to the various consuming devices.

For extracting metals the plant is arranged in combination with thermo-electric batteries by means of which the waste heat and gases are utilized to generate electric currents. These currents are passed through switches and induction coils, or condensers, or through batteries, and are afterwards used for lighting, heating, motive power, or other purposes.

[*Drawings.*]

APPENDIX.

1877.

A.D. 1877, October 18.—No. 3862.

STEVENSON, Anthony.—Machinery for dressing flour, or for washing or dressing grain, or other similar substances.

A cylindrical reel or screen, with pockets arranged round ts circumference, is placed on an inclined shaft and driven in any convenient way. If for dressing flour the screen is covered with silk, but for washing grain, washing the syrup from crystallized sugar, etc., it is covered with wire gauze and revolves in a tank, which may contain water. A segmental brush is

secured by a set-screw or otherwise to the inclined shaft, the top end of which carries an arm with a pin working in a semi-circular slot, at any part of which it may be secured so as to give any required inclination to the brush. By slackening the nut the brush will be left free to oscillate. The substance to be treated, which is introduced through a spout, is acted on by the brush, carried round by the pockets, and falls on to a deflecting-plate which guides it to the other side of the brush. The action continues until the material arrives at the further end of the reel, where the pockets may be so arranged as not to discharge their contents till they come over a discharging-spout.

[*Drawing.*]

1878.

A.D. 1878, March 4.—No. 878.

LAKE, William Robert.—(*A communication from the Celluloid Manufacturing Co.*)—Improvements in the manufacture of celluloid, and of articles formed of the same and analogous compositions and compounds.

Refers, *inter alia*, to the coating of metal bars or springs etc. with celluloid etc. The object to be coated is passed through a mass of the material, which is forced from a stuffing-box into a receptacle which is provided on one side with an inlet of suitable area to snugly correspond with the transverse section of the core, and on the opposite side with an outlet of such dimensions as to snugly encompass the transverse section of the core when coated.

[*Drawings.*]

A.D. 1878, April 18.—No. 1578.

GEDGE, William Edward.—(*A communication from Adolphe Vève.*)—Machinery or apparatus for separating, cleaning, hulling, washing, and drying grain and seeds.

The decorticated wheat is driven to the centre of a trough into which water is fed at the bottom. About a tenth of the water escapes by an opening near the top, carrying with it the chaff, smut, and lighter seeds, while the remainder escapes near the bottom, carrying the grain with it. An agitating-rake worked by a tappet and provided with teeth on both sides serves to submerge any floating wheat. A recess in the bottom of the trough near the outlet for the grain retains any stones, water being fed directly into it to prevent grain lodging therein. The trough may have one or more counter agitators to prevent the motion of the water due to the agitating-rake from carrying light matters past their proper outlet.

The grain and accompanying water then enter a horizontal cylinder of perforated sheet iron in which the washing is completed by a revolving beater with curved blades which carry the grain forward. This washing may be continued to any part of the cylinder by closing the perforations by bands of india-rubber, zinc, etc. The drying then begins, the water draining off. The drying-cylinder in its second part may have a revolving brusher of iron wire etc., or a thin metal scraper to remove the pellicles of grain which obstruct its holes, and a fan may be provided at the right end to produce a current of air. When the water has drained off the corn in the drying-cylinder, the beating must be stopped or the bran will be separated.

[*Drawings.*]

1879.

A.D. 1879, April 2.—No. 1315.

RAMSDEN, John Carter.—Operating upon iron and steel wire.

Hardening and tempering wire by passing it through a chamber heated by a burning spray of a hydrocarbon and through a cooling-liquid. For strong wire a heating-chamber is provided made of non-conducting material with a chimney and several pairs of nozzles at its entrance. One of each pair of nozzles is connected with a chamber containing a volatile hydrocarbon, which, by steam brought through the other nozzle, is drawn up and enters the chamber as a fine spray, which is lighted to heat the chamber. The wire passes from reels into the chamber and thence to reels immersed in cooling-liquid, where it is hardened. It is then put on other reels and passed through a cooler part of the chamber, and thence to reels immersed in a fatty liquid, where it is tempered.

A modification of the apparatus is described for fine wire, in which the chamber is provided with a horizontal partition, the spray being supplied by nozzles through holes in the wall of the lower part of the chamber, and the heated products passing through holes at the sides of the partition into the upper part, in which the wire is heated. The heated wire in this case is cooled by passing over a plate on which oil is flowing, and is then led through a heated bath of linseed oil, mercury, or lead for tempering.

In the Provisional Specification are also described improvements in annealing wire, in converting iron wire into steel, and in preventing wire from rusting. Strong wire is annealed by passing it through a heating-chamber similar to that above-mentioned and then through cooling-chambers. For fine wire a tube is used closed at both ends, but with a small hole in each end to let the wire pass. The nozzles in this case are received into a short branch of the tube, and there is also a longer branch connected with the chimney.

[*Drawing.*]

1880.

A.D. 1880, October 4.—No. 4026.

LAKE, WILLIAM ROBERT.—(*A communication from Alexandre Magaud.*)—Composition and process for hardening cement, lime, stone, wood, or other materials.

The materials are treated with a solution of sulphate of copper, iron, or zinc, or of these mixed, colouring or odoriferous matter being added if necessary. The solution may be applied to articles of cement, lime, plaster, and some kinds of stone, directly with a brush or by similar means, or by immersing the article in the solution. In treating metals, a layer of cement is first applied, and this is treated with the solution.

[*No Drawings.*]

A.D. 1880, December 22.—No. 5372.

BIGGS, JOHN HOWARD WORTHINGTON.—The manufacture of salt for domestic, manufacturing, and other purposes.

Improvements in the invention described in Specifications No. 4324, A.D. 1876, Nos. 1788 and 2106, A.D. 1877, No. 1336, A.D. 1878, and No. 5350, A.D. 1880.

For washing the salt crystals, the salt is placed in a wagon having a perforated bottom, and is then passed beneath the perforated bottom of a chamber through which a shower of purified brine falls. The brine is passed from a tank into the latter chamber through a valve which is automatically opened and closed by cams on a rotating shaft. In another apparatus, the salt as it falls down a tube is washed by a spray of brine, and both fall on to a valve at the bottom of the tube. The brine escapes through suitable holes, and when dry the salt is discharged through the valve into a wagon. In an apparatus shown for washing rock salt, the material is placed in two perforated cages hung in frames hung from the ends of a chain passing over a wheel which is rotated to and fro and dips the

cages into brine or water in a tank. After being dipped the cages are tipped and discharge the salt down a shoot into a wagon or to rotating ledged cylinders, through which the salt and currents of brine are passed to further remove the dirt &c.

Washing, drying, storing, and caking salt.—The pan has a gauze bottom through which a current of brine is passed upwards from a tank below. The salt is fed into the pan from a hopper, and is carried along the bottom by scrapers attached to endless chains. The fine particles are carried by the upward current to a trough or overflow pipe, while the heavier particles fall into a trough, from which they are removed by a worm to an elevator. The bottom of the pan may be perforated for a portion only of its length, and arranged so that the scrapers carry the salt over the end of the pan and deliver it into a wagon. In another apparatus the salt falls from a hopper in a thin layer upon the permeable surface of a rotating annular table through which brine from a central tank rises. The brine and the finer particles flow into a trough placed between the central tank and the table, and are removed thence through a siphon pipe. As the table rotates the salt is stirred up by scrapers, and is finally forced up an incline placed over the table, and is removed thence by scrapers. Currents of air or steam may be used under suitable sieves or rollers to transfer the lighter particles to a settling-chamber or elsewhere. To remove deliquescence from salt it is fed upon an annular rotating table, having a permeable surface. Over one half of the table is a series of perforated pipes from which brine is showered upon the salt as it passes beneath. The salt is thus alternately washed and drained during one half of the revolution of the table, and during the other half is dried by a current of air which is drawn through the table assisted by hot air blown over the table. The dried salt is then passed up an inclined plane, from which it is removed by a scraper and carried by a belt to the store. To remove any salt which may cling to the permeable surface a pressure of air is maintained beneath, or increased exhaust is maintained above the table at the point of delivery, and the salt thus loosened is removed by a brush and the surface is washed, brushed, and dried before receiving a fresh deposit of salt. The table may be arranged with an inner ring upon which the salt is washed and an outer ring upon which it is dried, the salt being moved from one ring to the

other by endless scrapers. To cake salt upon rotating exhaust tables, showers of boiling brine or jets of steam are used to saturate the salt, and hot air is then drawn through it. The salt is cut into rings or strips by vertical knives so that the currents of air harden the sides of the cakes, which are then cut across and undercut to produce small blocks which are removed from the table by a plate which tips them on to a carrier. The table may be circular rotating round a pivot, or annular travelling round a central cylindrical stove. The space beneath the table is made airtight by water joints, and a pressure of air is maintained beneath the table and passes through the table and dries the salt upon it. Reciprocating permeable surfaces may be used.

One form of centrifugal washing and drying apparatus consists of an outer case, a gauze drum with a sloping ring at its bottom, and an inner or screw drum which works the salt down as described in Specification No. 1336, A.D. 1878. The drums are driven by friction gear from a shaft. Brine is supplied by a pipe and funnel to a brine case in the inner drum for washing the salt as it descends. This drum is washed with jets of water or brine from perforated pipes supplied from a funnel. A chamber below the drums has an annular ring on which the salt thrown off from the bottom of the drum collects. The ring is rotated by a rack and pinion from the shaft driving the drums. The salt left on the ring is swept by a scraper into a pocket leading to an elevator and to a drain pipe, the passage being controlled by a valve. The salt is passed into the machine and a small quantity of cold saturated brine poured on to the top of the inner drum to wash the salt, which is afterwards washed with cold purified brine from a pipe. When all the salt has passed down and been removed to the elevator, the valve is turned and the gauze washed with brine or water which passes out through the drain pipe. The shoots directing the salt into the machines and from the machines, and the valves for controlling the supply of liquid, may be automatically operated. A device is also illustrated for evenly distributing the salt on the outer drum and a scraper for cleaning the blades of the screw drum. When the apparatus is used for drying or storing salt, air is passed upwards through an aperture into the inner drum by rotating vanes or a fan attached to the outer drum. The air after passing through the salt collects in the

case and is led away. Hot air may be admitted over the entire surface of the gauze drum and through the salt.

Another apparatus for washing and drying salt consists of two endless travelling belts having permeable surfaces. The salt is spread upon the first belt and carried beneath perforated pipes, which shower brine upon the salt whilst the belt passes over a case from which the air is exhausted. The salt is thus washed and drained and delivered to a hopper from which it is fed upon the second belt, which has previously received a layer of dry salt. The second belt carries the salt through a case in which a current of air is caused to pass upwards through the salt which, thus dried, is removed from the belt by a scraper. The first belt as it returns to receive a fresh supply of salt is passed through a water tank to wash it. The first belt may be replaced by a revolving gauze or permeable drum arranged with showering-pipes and means for exhausting the air from its interior.

[*Drawings.*]

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